This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

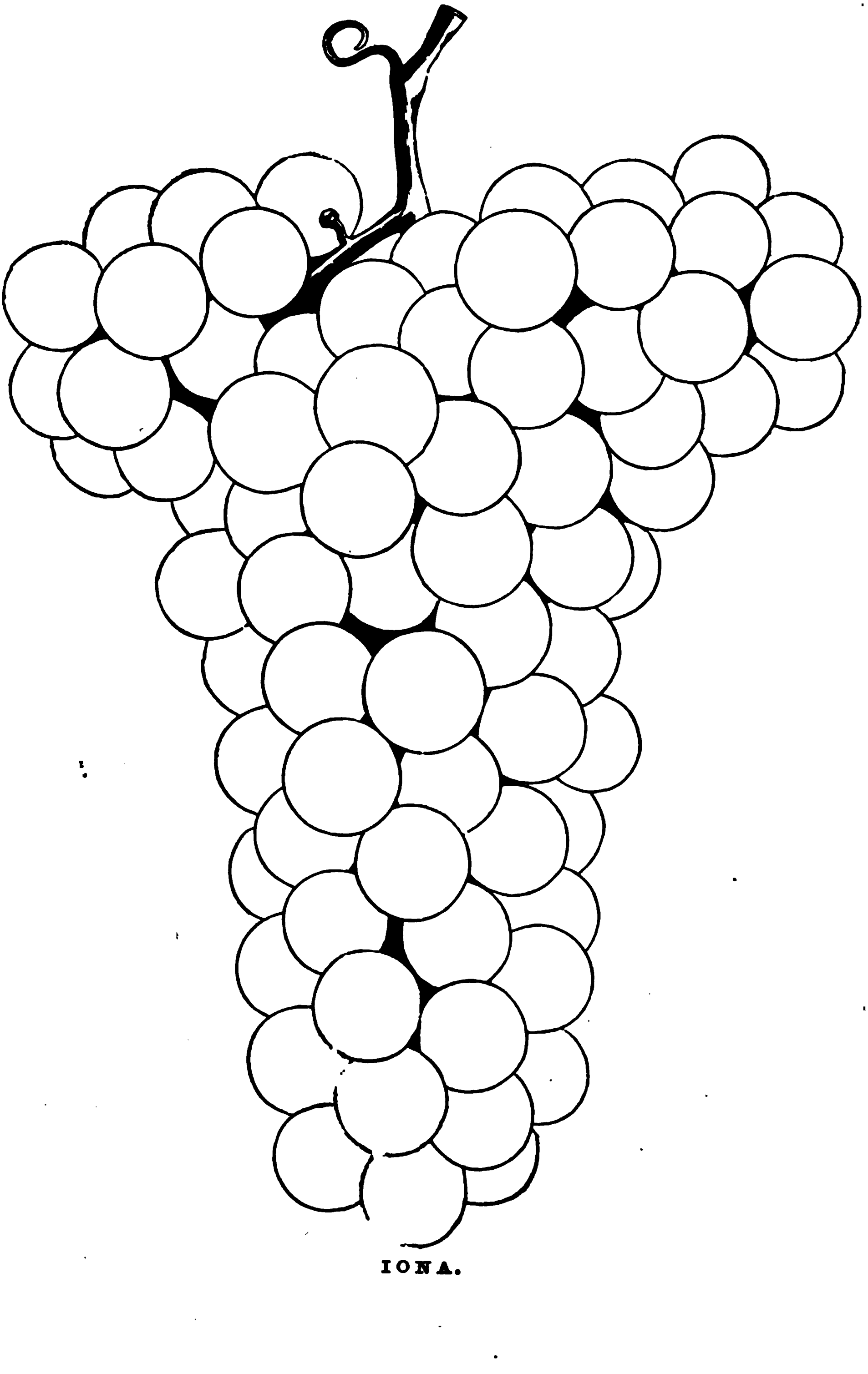
3 2044 106 348 634

HARVARD UNIVERSITY HERBARIUM.

THE GIFT OF

2
3cc
MR

LIBRARY OF THE GRAY HERBARIUM
HARVARD UNIVERSITY



IONA.

NINTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

MAINE BOARD OF AGRICULTURE.

1864.

AUGUSTA:
STEVENS & SAYWARD, PRINTERS TO THE STATE.
1864.

BOARD OF AGRICULTURE...1864.

JOHN F. ANDERSON, President.
CALVIN CHAMBERLAIN, Vice President.
S. L. GOODALE, Secretary.

NAME.	COUNTY.	P. O. ADDRESS.
	(Term expires January, 1867.)	
J. C. Weston,	Penobscot,	Bangor.
Samuel Wasson,	Hancock,	Ellsworth.
Seward Dill,	Franklin,	Phillips.
J. W. Haines,	Aroostook,	Maple Grove.
Lyman Lee,	Piscataquis,	Foxcroft.
W. R. Waterman,	Washington,	Robbinston.
	(Term expires January, 1866.)	
Calvin Chamberlain,	Maine State Society,	Foxcroft.
Harrison Jaquith,	Kennebec,	China.
Cyrus M. Pratt,	Androscoggin,	Greene Corner.
Sumner Leach,	Lincoln,	Warren.
	(Term expires January, 1865.)	
John F. Anderson,	Cumberland,	South Windham.
George A. Rogers,	Sagadahoc,	Topsham.
Amasa Bigelow,	Somerset,	Bloomfield.
John Bachelder,	Oxford,	North Fryeburg.
S. L. Goodale,	York,	Saco.

REPORT.

To the Senate and House of Representatives:

In accordance with the requirements of the organic act constituting the Board of Agriculture, I proceed, first, to lay before you a detailed account of its transactions at the last session.

The members assembled at the Agricultural Room in the Capitol, at Augusta, on the 20th of January, 1864. For purposes of organization, Mr. Rogers of Sagadahoc was appointed Chairman. A Committee on Credentials having reported a quorum present, the Board proceeded to the election of officers by the choice of

JOHN F. ANDERSON, *President.*
CALVIN CHAMBERLAIN, *Vice President.*
S. L. GOODALE, *Secretary.*

The rules of order prepared by a Committee of last year were adopted for use at the present session.

The President announced the Standing Committees as follows:

On Elections—Messrs. Lee, Leach and Pratt.

On Pay Roll—Messrs. Rogers, Dill and Waterman.

On Business—Messrs. Weston, Chamberlain and Wasson.

The Secretary read communications from Hon. Sidney Perham, M. C., and Hon. Isaac Newton, Commissioner of Agriculture, relating to copies of his Annual Report and also a quantity of seeds, for distribution to the members of the Board.

On motion of Mr. Anderson, the following resolves were adopted:

Resolved, That the thanks of the Maine Board of Agriculture be returned to the Hon. Sidney Perham and to the United States Commissioner of Agriculture for the seeds and Reports which have been received.

Resolved, That the Maine Board of Agriculture notice with satisfaction the improved character of the United States Agricultural

Report, compared with those that formerly emanated from the Patent Office Department.

The Secretary having presented and read a communication from Hon. George B. Loring of Massachusetts, in regard to the formation of a New England Agricultural Society, it was

Ordered, That a Committee of three be appointed, who are hereby authorized to act in behalf of the Board in relation to the proposition made by the Massachusetts Board of Agriculture relative to the formation of a New England Agricultural Society.

The President, Vice President and Secretary of the Board were constituted said Committee.

On motion of Mr. Chamberlain, it was

Ordered, That the Secretary be requested to communicate through the medium of the public press, the facts that the cattle disease known as Lung Murrain or Pleuro Pneumonia—contagious and incurable—exists at the present time in some parts of Massachusetts, and that there is eminent danger of its introduction hither, together with such suggestions as he may see fit to offer in connection therewith.

On motion of Mr. Wasson, it was

Ordered, That the Secretary of the Board of Agriculture be directed to call the attention of the Agricultural Committee of the Legislature to the fact that no standard of weight has been affixed by the statutes of Maine for parsnips, onions, turnips or beets; and also that the standard weight for beans, peas, ruta bagas, mangold wurtzel and sugar beets differs from that of Massachusetts, and to ask for such legislative action as necessity requires.

Dr. Weston presented some resolutions forwarded to him by the "Sheepkeepers' Association" of Penobscot County, as follows:

"*Resolved,* That the injury inflicted by dogs on sheep is severe and aggravated, and tends greatly to discourage the raising of these useful animals, and that in the opinion of this meeting the important interests of sheep husbandry demand of the Legislature the imposition of a tax of at least two dollars on each dog kept in the State.

Resolved, That the Legislature ought to enact a law requiring the owner of any dog to pay twice the value of each sheep injured or killed by him to its keeper, and when no owner can be found, or the fine is not paid within a specified time, that the life of the dog shall be forfeited."

Mr. Wasson said the law passed by the last Legislature for the taxation of dogs failed of effect simply because the enforcement of the law was left to the discretion of the towns. Some put it in force while others did not.

Dr. Weston believed we should ask for a tax of two dollars upon each dog.

Mr. Jaquith thought we should be apt to overdo the matter if we asked too much of the Legislature in this matter; thought we should recommend a tax of one dollar each on dogs—not leaving it with the towns—and that the money so raised should constitute a fund for the payment of the losses caused by the ravages of dogs to sheep.

Mr. Goodale said it was not the province of the Board to dictate laws; but he believed the Board should demand, in behalf of the farmers of the State, protection to sheep husbandry against dogs, and leave it to the Legislature to make such a law as was required.

Mr. Anderson thought the resolves should be amended by asking for a tax of one dollar instead of two, as the resolves asked for. The object of the tax was designed to remove a special hindrance to sheep husbandry, and not as a tax upon the dog as a revenue based upon the value of the animal.

Mr. Bigelow agreed with the remarks of Mr. Goodale, and made a few remarks in favor thereof, drawn from his own experience; believed the best means of getting rid of the dogs was to kill them.

The resolves were referred to a Committee, who subsequently reported for the adoption of the Board the following resolution:

Resolved, That in the opinion of the Board of Agriculture, the important interests of sheep husbandry demand of the Legislature the enactment of a law which shall impose a tax on all the dogs kept in the State, sufficiently large to afford adequate protection; and that the imposition of this tax should not be left to the discretion of the several cities and towns, but should be imperative.

The resolution was adopted, and the Secretary was instructed to lay the same before the Legislative Committee on Agriculture.

It may not be improper here to say that, *as usual,* no action was taken by the Legislature in this matter. One reason, and perhaps the most potent one, undoubtedly is because the leading politicians of the party dominant at *any time* are unwilling to incur the ridicule which may attach, however unjustly, to a so called *dog law,* and which the opposition would use to their disadvantage. When the voters understand this, and will take care of the *ridicule*, they can have protection to sheep husbandry as easily as anything else they ask for.

At an informal meeting, the subject of sheep husbandry was discussed, and some of the statements are given below.

Mr. Haines desired information regarding a disease with which lambs are affected in Aroostook County, but which he had never known elsewhere. They have swelled necks when they are born, and usually die in about a week. (Scrofula?) From some of them he had cut out bunches half as large as an egg. In some cases one-fourth of the sheep died.

Best Time to Shear Sheep. Dr. Weston said the farmers in Penobscot County were beginning to shear their sheep in April, and thought the plan had much to recommend it.

Mr. Bigelow. Never shears his sheep until warm weather, if it is not until July. Washes before shearing. The wool would not be so clean by washing in April as it would to wash in June. Had never sheared earlier than the 15th of June. Keeps the Spanish Merino, and when selecting a buck pays particular attention to the form and build of the animal, regarding it as equal in importance to the quality of the wool. Invariably feeds his sheep upon the snow in cool weather. In moderate weather in winter prefers to have them in an open yard, rather than crowded together in an unventilated place. Feeds often, giving just what they will eat. Can winter six sheep upon the hay that would keep a cow. A mixture of grasses is preferred for sheep.

Hon. Mr. Hitchborn, in response to a call from the Chair, made some interesting remarks regarding the importance of sheep husbandry to our State; referred to the vast amount of money sent out for foreign wool, and which should be kept at home; and also of the great interests of agriculture as the leading pursuit of the people of Maine.

Mr. Haymer said that in Hancock County the subject of wool-growing was gaining in interest among the farmers. They have come to the conclusion that it is better to shear early—from the first to the middle of April—and as a reason, the sheep are at that season generally housed and protected from the cold rains of May.

Mr. Wasson. The practice of shearing early is gaining favor with our farmers. Some shear as early as March. He sheared last year in April, but took a less number of pounds of wool from the same sheep than he did years before. Thought lambs should come early—as early as February—could put them in market by the first of July, and thereby saves an immense amount of hay. If lambs have eaten poison laurel, he gives the white of an egg and lard, which almost invariably proves an antidote—but if it does not, gives pennyroyal tea made pretty strong. Would not have sheep washed before shearing.

Mr. Dill. Usually washes sheep about the 10th of May; shears about the middle of June. He read the following statement from Franklin County:

The flock of Mr. J. M. Bass of East Wilton consisted last year of fifty-one ewes, two bucks, and one wether—total, fifty-four. His flock sheared 551 pounds 14 ounces of unwashed wool; raised two lambs, (lost one,) had twenty yearlings and thirty-three old ewes, and six had no lambs. Deducting one-fourth for unwashed wool, and the amount will stand thus:

Receipts.

554⅞ lbs. wool at 80 cents (20 per ct. out), 60 cents,	$332 92
Sold 12 buck lambs,	104 00
Kept 16 ewe lambs, value,	160 00
	$596 92

Expenses of Keeping.

Fifty-four sheep at $2 per head,	$108 00
Washing and shearing,	9 00
Interest on value of sheep,	48 60
Taxes, 1 per cent.,	8 10
Insurance, 1 per cent,	8 10
	$181 80
Giving a net gain of	$415 12

Mr. Leach. Within a year or two the farmers in Lincoln County have formed the practice of shearing sheep as early as April, and he had not known a sheep to die from the practice. For himself, he was fully convinced the plan was a good one.

Mr. Bigelow. It is not uncommon to have ewes shear eight pounds each in our section. He believed the Merinos to be the hardiest sheep raised in Maine. They are younger at eight years old than most other breeds are at six.

Rev. Mr. Ellis of Aroostook County gave some account of sheep husbandry in Aroostook County, and the improvements that have been made upon the coarse-wooled breeds in that section. He could not see the humanity or advantage of shearing sheep in April.

Mr. Jaquith. Does not wash his sheep until after the May rains are over, as a general thing, but if he does, he does not shear until after that time.

Mr. Rogers agreed with the remarks of the gentleman from Aroostook, and believed it to be a barbarous practice to shear sheep in April. It was his custom to shear about the middle of May. Had rather not have lambs come until sheep get out to pasture. Believed ten sheep could be kept as cheap as one cow.

In some further remarks made by Mr. Haymer concerning the keeping of sheep upon the outer islands along the coast of the State, he stated that although the plan had many advantages, it also possessed two serious difficulties. One was that on those islands where there was a ledge and bar covered by the tide, but exposed at ebb water, the sheep were apt to go out on the bar and get washed off by the tide; and the other was the depredations of thieves.

Dr. Weston, from the Business Committee, reported the following as a partial list of topics for discussion at the regular meetings—the Committees being appointed by the Chair:

1. "What effect would the increase of manufactures have upon agriculture?" Messrs. Weston, Pratt and Bigelow.

2. "What action should the Board of Agriculture advise in respect to an Agricultural College?" Messrs. Goodale, Weston and Chamberlain.

3. "By what methods might the usefulness of Agricultural Societies be increased?" Messrs. Chamberlain, Jaquith and Waterman.

4. "What has been the most profitable branch of husbandry the past year?" Messrs. Rogers, Haines and Lee.

5. "What is the relative value of meadow hay for feeding stock, in comparison with English grasses?" Messrs. Anderson, Haines and Bachelder.

6. "Ought the Geological Survey of the State to be resumed and completed?" Messrs. Anderson, Lee and Jaquith.

It having been customary for the members to investigate some subjects during the interim, and to report thereon at the meeting of the Board, the following papers which had been thus prepared were read:

Mr. Chamberlain submitted the following paper

ON IMPROVED AGRICULTURE.

"Improved agriculture" is the embodiment of an idea for which we all have labored these many years—the topic on which we are supposed to think intently and should act vigorously. It is suggestive of a review of all we know of man's history, and our knowledge of the physical laws and conditions attendant on the race in the present.

Man, grouped in nationalities, exhibits growth, culmination and decline. National wealth and power means agriculture, social organization, intelligence, enterprise, commerce. Nations, civilizations, epochs and eras, move in cycles; each round of ages but a repetition on a variable scale. The principal civilizations of antiquity—Assyria, Egypt, Etruria, Greece and Rome, may have been separated by great gulfs of barbarism. Monumental evidence of a grandly-developed system of pre-historic civilization exists, not only from Britain to India, but also on this continent, from Canada to Peru. We are the heirs of long-buried generations, whose mighty labors and heroic deeds are left in monumental records. Judging by these, their minds must have been great, and their purposes grand.

The earth-works of America, the Cyclopean remains in Southern Europe, and later, the time-enduring pyramids of Egypt, are public works, that, for the resources at command, transcend anything that later ages have accomplished.

Not the least of monumental evidence of past civilization, is the stupendous remains of former systems of irrigation. The Assyrians, Babylonians, Egyptians, Etrurians, Indians, Chinese, and thousands of years later, the Saracens in Spain, constructed beautiful systems of irrigation, that contributed on a vast scale, to the agricultural capabilities of densely peopled countries, through long ages.

On this continent, in ancient Peru, the Spaniards found the most costly works for irrigating lands. Canals and aqueducts crossed the low lands in all directions, spreading over the country in a vast network, diffusing fertility and beauty around. The Spaniards on their arrival in Mexico were astonished at the perfection to which horticulture was carried through the same means. The feudal eras of Europe were active periods of the canal system of irrigation—an age in which were reared the Gothic Cathedrals and the beautiful Abbeys—an age in which intellectual culture in its highest forms were blessings attendant only on the few. Learned men of the present age claim to have the evidence that of the arts, the ancients knew more about the manufacture of glass than we do. Telescopes, microscopes, and opera glasses, are said to have been used thousands of years before the time of Galileo. The ancients were our superiors in the manufacture of metals. According to some they had the steamboat and the canal, and could move building stones of three thousand tons each. They had iron railroads. They had, in some form, the balloon and the telegraph, the stereoscope and the mowing-machine. In the printing-press, the great discovery of modern times, we see hope for a higher and more enduring civilization than in the waves of the past.

An oriental ambassador, on visiting our country, made the sage remark that this was *a young country, but a very old people.* Had he been permitted to have explored farther and read the record of science aright, he might have modified his opinion in regard to the age of this Western Hemisphere—the "New World"—where stands individual specimens of growing vegetables where they have stood in security since their growth commenced, seven thousand years ago; and where the fossil remains of man prove him to have been an inhabitant of these vast plains prior to the last great change in the polarity of the earth. The remark that we are a very old people, should also be modified, the opinion having been based on an exhibition of our wondrous activity and energy in business, and our mechanical tact. Our family genealogy is nothing to boast of. Derived from a composite stock, we are a concrete people, and can look back on a dark wave of comparative barbarism from whence we have just emerged. England, our great prototype, has excelled in commerce and manufactures, rather than in agriculture. She has been an instance where a dense population has existed, measurably, on lands that have not afforded them sustenance. The talent of her people has not heretofore gone out in the direction of supplying the nation's bread from her own soil; else how could she now say that her agricultural products have been doubled in the last thirty years? Circumstances effect more in the formation of character in the individual or the nation, than innate greatness or goodness.

Other nations affect to sneer at our conceit in having a certain "destiny" to work out on this continent. We certainly shall work it out, and it will be a noble destiny, unless we misapply the stupendous power that we already have accumulated. The men who settled these shores were made suitable for the task. Their immediate descendants wielded with tremendous physical force their rude implements. As population increased, cities were built, commerce, traffic, the mechanic arts, &c., divided the attention of the people, taking a constantly increasing proportion from the primary occupation—agriculture; thus creating a constant demand for increased production through improved facilities. For a long time the almost entire absence of internal trade, through the difficulties of transit, left each rural district dependent on its rude mechanics for articles of prime necessity. It is within our recollection that the country blacksmith made the farmer's plow, his hay and manure forks, &c. The very vastness of the country contributed to delay the time when agricultural operations should be conducted with thoroughness. New lands, and more attractive, enticed men westward from our rugged shore, dispersing our increased population over vast areas, and thus saving the first settled provinces from feeling anything akin to the discomforts of a crowded population. Improvements for inter-communication, to keep pace with the progress of the country in other respects, were entered upon with vigor, under the lead of the master minds of the age. The prosecution of these public works encouraged the immigration of vast numbers of laborers from the Eastern Continent. These thoroughfares when opened served as an additional escape-valve to the population of the Eastern States, and at the same time to bring to us the agricultural products of the West cheaper than we had learned to produce them at home.

This cursory view brings us down to a day not twenty years removed from the present. Agriculture had, through all that time, if not through the *force*, certainly through the *lead* of circumstances, been conducted on an exhaustive plan. The farms that had been kept at their original fertility, or been raised above it, were the exceptions—few and far between. Minds, observant and deep, were not wanting to warn the people against a course so destructive. Washington, Jefferson, the Adamses, Quincy, Buel, Clay, Webster, and other worthies, by precept and practice labored to stay the current running to swift destruction, but in vain. The temptation of present gain could not be withstood by those who knew better; but the masses knew no better way. We give man the credit of acting, in the main, in accordance with his highest light. The men who have cleared farms in Maine, reared families, exhausted their acres, sold their effects and "moved to Ohio," exhausted a farm there, again "pulled up stakes" and "gone out West," are not to be blamed for any mischief they may have done by over-cropping the lands they have occupied. They have acted their part as pioneers, and the world had need of them in that capacity.

It is far easier to find fault with the men who have cleared away the forests for us, and done battle with savages and wild beasts, than it is to so regulate our own actions and perform our labors with wisdom, that future generations may see no good cause to complain of us.

We in the present, have committed to us a goodly heritage, and if we fail to transmit it to our successors with improvements, we shall live in vain. In order to thus transmit it, we must look well to its present condition. Such has been the decline in agricultural products in all the older States, through the exhaustion of the soil, that an immediate and radical change in our husbandry is demanded. The last twenty years, we may hope, have witnessed the lowest ebb of the tide in this regard. Science has stepped in to relieve husbandry somewhat of its former monotony; and our agricultural literature from thousands of earnest men, has, through associated labors, and the mighty printing-press, been so liberally and generally diffused, that the tide may already have been turned in the right direction.

In this transition state, with comparatively little new lands to be added to our domain, and much to be renovated, the future success of the nation should be made dependent on the combined wisdom and talent of all, under the most favorable circumstances of peace and prosperity. But with a clouded horizon we must lean a little more on hope. The darkest political obscuration cannot obliterate physical facts. Here the beneficent hand of Nature, so divinely wise in all the vast planning, has been lavish of her gifts. We see here laid out a vast continent, accessible in every border and boundary, interwoven with rivers, lakes and mountains, a climate diversified and harmoniously adapted to every want which the most extravagant imagination could desire. With a reasonable appreciation of so many and so rich blessings, the task would seem easy to perpetuate here a republic, where future generations could not fail to be recognized powerful among the nations of the earth.

In the last few years, the most notable change in our husbandry, has been in the increased substitution of new and improved machinery for human labor. This has been only the natural result of the pre-existing conditions in society, as we have attempted to show. Circumstances had made our people self-reliant, and they had accumulated a surpassing amount of latent thought and inventive ability.

It now becomes an interesting question, What are the conditions of continued progress and prosperity? On this point, the United States' Commissioner of Agriculture says: "1st, Peace; 2d, a continued and increasing demand for agricultural products, both at home and abroad; 3d, an increased respect for labor; 4th, a more thorough knowledge and practice of agriculture as an art and science; 5th, a more thorough education of our farmers in the physical sciences, in political economy, in taste, and general reading."

A state of war reduces the productive industry of a country, by the transfer of labor. But in our present case there are compensating circumstances of considerable moment, in the increased skill and energy taking the place of the old system, the inflow of agricultural labor from Europe, and the more extensive use of labor-saving machines.

It will take considerable time to eradicate the habit that has been formed in cultivating a primitive soil. But with a teachable disposition the wrong may be unlearned, and much of the right learned in valuable lessons now offered by the older nations. If China and Japan were to adopt our methods of tillage, famine would soon reduce their population by hundreds of millions. But their spade labor would not now do for us, neither would our mowers, reapers, or a steam-plow, do for them, on their terraced hills. But in their habit of prudently saving and applying manure, minute culture, rotation of crops, and irrigation wherever possible, we might take them for our teachers with advantage.

One of the most efficient means to rapid improvement in agriculture in modern times, as well as to the general progress of the world in civilization, has been the grand series of international exhibitions, inaugurated in 1851. If any parties in these exhibitions were surprised in meeting facts that had not been disclosed through the ordinary road of commerce, they were the older nations, at the utilitarian inventions of these States.

We have hinted at the contributions of science to modern husbandry. The inductive philosophy of Lord Bacon, two hundred years ago, taught man to experiment, to question, and test nature as she is presented in soils, gases and phenomena—a philosophy, positive, progressive and eternal. From that time, numerous experiments were made in soils to ascertain the causes of fertility, and through them the way was prepared for much subsequent scientific résearch. At the beginning of the present century, Sir Humphrey Davy established agricultural chemistry as a department of science. He developed the principle, that the productions of the soil derive their component elements from the surrounding atmosphere, or from the soil. He showed that in the process of vegetation, there was a perpetual assimilation of various substances to the organs of plants, through the exertions of their life powers, and their chemical affinities, aided by light, heat and moisture. He analyzed soils and plants, and showed what properties and conditions would best furnish the elements needed in their cultivation. These ideas reduced to practice by some of the leading landholders of England, soon produced a marked effect on the agriculture of the kingdom, and has turned a fourth part of the area of England from an unproductive wild into a garden.

In this connection, Sir H. Davy remarked, that "Nothing is impossible to labor aided by science." It is such expressions indulged in by profound thinkers, and echoed by the enthusiastic, (and this hall has contributed its quota of glib talk,) that has magnified the subject of agricultural chemistry to unreal and fantastic proportions, and exposed the whole subject matter fairly to the charge of "science run mad." We have seen pretenders "making a very good living," canvassing our State, lecturing on Agricultural Chemistry, (and any other topic that the locality was specially hungry for,) taking from enterprising farmers a specimen of soil with a fee of five dollars in advance, under the promise of a full and reliable analysis for that sum. Our impression is, that all who have so invested for minute doses of science, have found both their *dirt* and *money* clean gone, with never a show of an equivalent.

We name these cases only to show how high the public expectation has been raised in this direction. It is now generally conceded that, although analysis may furnish useful hints for the improvement of the soil and the successful culture of many fruits and crops, yet it affords no sure guide to the farmer, and for all practical purposes has been abandoned. The extent of its use is to furnish a basis on which to found an opinion for correct treatment.

Dr. E. Pugh recently replied to an inquiry as to the value and cost of analyzing soil and plants, briefly, as follows: "It will afford the farmer no practical benefit to get either his soil or plant ashes analyzed; and this, if well done, will cost from $2000 to $5000 for one analysis." Having thus been let down rather abruptly from these inflated expectations, we have still an excellent road to progress over the plain; and as we advance we do not forget the real mission of chemistry with its stores of facts; and geology, botany and entomology at our every step open to our vision the rich gems of the physical world, while natural and mechanical philosophy must eventually reach to, and expand the mind of every farm laborer. This is the tendency and inevitable result of the use of improved machinery.

The history of all manufactures teaches that machinery is the best friend of the laborer. As improved agricultural machinery increases, the demand for farm labor increases also, wages rise, and what is more and better, the labor must be of a higher grade, not performed by mere brute force, but requiring education, ingenuity, skill—labor more elevating to the laborer.

We have thus treated our subject generally, but have not been forgetful of Maine as an integrant of the progressive family, and having a direct interest in it all. One physical fact is noticeable in this State, and it is probably equally true of all other places—that as the forests are cleared away, we are more subject to the casualty of summer drouth.

This law will compel the future culturist to take control of the water streams, and husband the surplus of one season for the supply of his crops through the other. This matter—the control of water—considered both as drainage and irrigation, is a vast matter, and under the heat of our clear, summer sky, will ultimately be wrought out into a grand system, equalling the achievements of former ages. As we pass over our State, one great, permanent want stands out unmistakably at every mile—the want of population. We perceive "the aching void," made by the departure of our kindred to people other States. Alongside of well-made roads, good land, cleared of wood, producing next to nothing, for the want of a working population is the general aspect of much of the interior portion of the State. Who can say that these lands, in smaller farms, may not furnish homes as desirable as the small allotments sought for on the sands of Long Island or New Jersey? With an increased rural population, the burthens of society are lessened, and social privileges augmented.

But we may hope that present ills are only temporary, and that Maine, with recuperative force, appropriating to her wants from the general storehouse of knowledge and of good, with her inherent elements of wealth and power, physical and mental, may rise equal to the most favored country and people, and down the long vista of time be the kind mother of millions of progressive people who may never shun physical labor, but join thereto all science and art, and ever rely on a generous soil that never suffers to go unrewarded any favor that may be bestowed on her, under the operations of an *improved agriculture.*

The paper was accepted, and placed at the disposal of the Secretary.

Mr. Lee presented the following paper on

THE CULTURE OF WHEAT.

Wheat has been regarded as the most important of all the grain crops raised in Maine, as it is in its highest sense the staff of life. The farmers have had such continued experience in its yearly culture, that it would seem as if but little, if any, new light or profitable suggestions could be made upon the subject. The fact that it is a very uncertain crop in this State no one will deny, though some localities are more favorable than others. In the years 1861 and 1862 wheat did very well, the seasons being favorable to the filling out of the kernel. The returns in this State for 1861 show the number of bushels to be 210,850, and the year 1862 show 215,899, while about half of the towns made no returns at all, which would increase the above number of bushels as many thousands more. The yield for 1863, with a much larger breadth sown than the previous year, will fall much below that of 1862—nearly one-third in quantity and quality, with equal or better cultivation.

Now what is, and where can the reason be for the depreciation of the yield the past season? Is its failure to be attributed to the nature or condition of the soil mainly? No; for it is the practice among the farmers to sow wheat upon their best cultivated, enriched land, usually following Indian corn the previous year. There is but little difficulty in realizing a good growth of straw. Is the wheat midge then the principal fault? We say not; for the insect has been defeated somewhat by both early and late sowing. The greatest cause of the failure of the spring wheat crop in Maine, by careful investigation, is the rust or mildew upon the stalk, at the time of the maturing of the kernel, though this difficulty varies somewhat by the location, whether on high, hilly, or more level, plain lands. Wheat sown upon the elevated or hill farms has suffered but little from the ravages of the insect, compared with the injury done the crops in the valleys. The same is also true to some extent in regard to the rust, supposing the reason to be the greater prevalence of winds sweeping over the elevated lands, thus preventing somewhat the extensive operation of the winged insect that deposits within the husk enclosing the kernel, the egg of the so-called weevil. By keeping the grain in motion, it is difficult for the midge-fly to deposit its egg. It also requires a moist atmosphere to be successful in its operations, which is less favorable upon the hills where the wind has free circulation. So in regard to rust upon the straw. If the weather be warm and wet for several days in succession, while the kernel is maturing, the rust is very sure to strike the straw, and thus destroy the crop; whereas, if the weather be dry with cool nights, the crop matures, and a good harvest is the result. The great point, then, in raising wheat in Maine successfully, depends upon the state of the weather during the maturing of the kernel. So, as the farmers cannot foretell, at seed time, what will be the state of the weather at the time of harvest—whether wet or dry—they must act their judgment, and commit their seed to the soil, and trust to the weather as heretofore for the result, regarding it as an uncertain crop. Our farmers usually sow their wheat upon ground manured and planted to corn and potatoes the previous year. That grown after corn yields much the best, as wheat and potatoes both partake largely of potash, and this is doubtless the reason why wheat does not yield so well after those crops. Before sowing wheat it should be cleansed by sifting and washing it from all smut and foul seed—

for what kind a man sows, that shall he also reap. Smut can be prevented by soaking the seed twenty-four hours in blue vitriol water, two ounces to the bushel of seed. On land which is free from rocks and stumps, two bushels should be sown to the acre.

Therefore, considering the prices of the several cereals at the present time grown by our farmers, it will pay much better to sow barley than wheat, especially upon that portion of our soil lying upon the plains and valleys. Barley is a good crop to seed grass with, and does not draw from the soil so severely as oats, and is not liable to injury by the midge or rust.

At the opening of the ground in the spring it is the principal study of the farmer to decide, in his own mind, what kind of crop will be likely to pay him the largest returns for his labor; and taking into account the present ruling prices for farm products, it will at once be decided to raise barley, oats and potatoes, instead of wheat—and purchase our flour from the west.

This paper elicited considerable discussion.

Mr. Dill said wheat sowed the twentieth of May was injured so badly by the weevil that it was cut for fodder, but early sown wheat yielded well.

Mr. Jaquith had raised thirteen bushels from one bushel's sowing, which seemed to contradict the statement in the report that certain qualities in the soil necessary to the production of wheat were wanting in some fields. There were farmers in his town who always raised their own wheat, and they sow it whenever their land is ready—varying from middle of May to seventh of June.

Mr. Leach had raised one crop of wheat on land prepared in the fall and sown the first of April, but the weevil injured it badly. Wheat was injured more in his section last year by the blight than it was by the weevil. Always had a good growth of straw, unless in a very dry year.

The Chairman said in some parts of his county they were changing from spring wheat to winter, and seeding down to timothy, not so much for the wheat, but that they may get their lands to grass in good order. In the spring they sow clover, and cradle off the wheat—harvesting from eight to sixteen bushels per acre. Believed that a freer use of lime would be a great benefit in the growing of wheat and all other cereals. He had used oyster shell lime, and found it to be a great advantage. Applied it at the rate of from twenty to thirty bushels per acre. It makes the straw of the grain stronger and the yield heavier, and its effect is seen in the better production of grass. Had seen no difference in the effect of Thomaston lime and oyster shell lime. Used the latter because cheaper.

He also remarked that he had the best success in seeding down land with fodder corn. It was sown broadcast, as thick as it could be grown. Last year had over an acre laid down in this way. The stubble of the corn did not interfere with the mowing of the grass. The high state of cultivation of the land caused a better catch of the grass seed.

Mr. Rogers said the farmers had been driven from the wheat field in his vicinity by the ravages of the midge, though an occasional good crop is often obtained.

Mr. Pratt. The culture of wheat has been abandoned in our vicinity, except upon the high land; but even there the wheat crop was much smaller last year than usual, probably from the occurrence of rust.

Mr. Haines said the farmers in his section had formerly got good crops by sowing early, but during a few years past it has failed, even if sown early. It has also failed on high ridges where wheat has always been grown before with good results. He said that Mr. Cary of Houlton, had succeeded well by preparing his ground in fall and sowing very early—sometimes on the snow. The kernels of wheat seemed to blight when it was just forming. Good growth of straw generally.

Mr. Bigelow remarked that while good crops were raised in the northern and newer portions of Somerset county, in his own section it was a general failure. Last year he had a crop sown on very high land, but it seemed to blight. The straw turned white, beginning at the top of the head first. It had a heavy growth of straw. Believed the Board should not recommend the cultivation of wheat to the farmers of this State.

Mr. Lee of Piscataquis, remarked that he had got tired of sowing his richest land to wheat and raising only a good crop of straw. The farmers sow their wheat very early in the spring. Winter wheat is not cultivated.

Mr. Dill. Farmers with us sow very early—having their land prepared in the fall—and on high land; it is seldom the crop fails. If the land is prepared in the fall it can be sown by first of April, and as wheat likes a hard soil it is better to have the land prepared in the fall; the tooth of the harrow will lighten the soil enough.

Mr. Chamberlain said in his vicinity the wheat crop last year was very light, and the failure was caused by the weevil entirely; the straw was very bright in nearly all instances.

Mr. Haines stated that he had found weevils in a forty bushel crop of wheat;—that the Siberian tea wheat had succeeded best with him.

Mr. Wasson, at some length, reviewed the causes of the diminution of the wheat crop, the various opinions of farmers why it was not so successful as formerly, and of the opinions of scientific men in regard to the real cause of its failure.

The paper was accepted, and placed at the disposal of the Secretary.

Mr. Rogers presented the following paper

ON SALT AS A FERTILIZER.

Owing to a press of business this subject has not received that attention which it should have had, consequently, in reporting at this time, I am unable to do so with any degree of definiteness in regard to the matter.

It seems to be a very generally received opinion that salt acts beneficially as a fertilizer. Whether that conclusion has been arrived at as the result of experience, or whether it has been adopted by general consent, without regard to facts, the writer is unable to say. In presenting this article he does it with a view to elicit discussion, and thus to obtain something reliable, rather than as a report of facts in regard to the subject.

Boussingault remarks, that "the action of common salt as a fertilizer is very obscure. Many skilful husbandmen question its efficacy. Nevertheless, when moderately employed, it seems to do good."

Browne, in his American Muck Book, after stating that salt has been employed in all ages, and in all countries, for the purpose of promoting vegetation, says: "Yet it would be difficult to name any other substance in the catalogue of modern fertilizers, the powers of which have been subject to so much controversy, and even doubted and denied as exercising any beneficial effects to the crops to which it has been applied." He, however, concludes that it does act beneficially as a manure, and cites an experiment conducted in England upon potatoes, and various kinds of garden produce, the yield of which appeared to be considerably increased by the application of salt.

He says further, that "applied to grain crops on light soils, at the rate of five hundred or six hundred pounds to the acre, salt increases the produce of seed and very much improves its weight and quality;" and with regard to the destruction of vermin by means of salt, he asserts that "there is no agricultural use of it more undoubted." This latter assertion, we think, is not in accordance with facts, unless it is applied in such quantities as not alone to destroy the vermin, but also all vegetation, and render the soil sterile and unfruitful, as was customary in olden time, in order to completely destroy a conquered city and rendered it uninhabitable. We read in scripture that Abimelech took the city of Shechem, "and beat down the city and sowed it salt," that the soil might be forever unfruitful.

Sir Humphrey Davy supposed that where salt acts as a manure, it is probably by entering into the composition of the plant. A mixture of salt and quick lime in the proportion of one part of the former dissolved in water, to three of the latter, is recommended as being a valuable auxiliary to muck and other matter in the compost heap. It is said to be an established fact, that salt when used in small quantities, instead of preserving animal or vegetable matter, hastens its decomposition. If such be the fact, a slight application of it may be beneficial to plants, by hastening the decomposition of vegetable and other matter in the soil. One member of this Board informs us that he has derived benefit from an application of salt to his pasture land. We have frequently thrown fish pickle and refuse salt upon parts of our garden, but failed to notice any perceptible benefit to crops resulting therefrom, excepting perhaps where it may have been applied about cabbages.

The last season, after having prepared a piece of ground for potatoes, and when planting, salt was applied at the rate of a handful to a hill, placed around the potato, generally at sufficient distance from the tuber as not to injure the sprout. There was no perceptible difference in the growth of these potatoes from those adjoining, where no salt was applied, excepting in a few instances where it was placed in too close proximity to the tuber, in which case they either did not come at all, or if so, grew very feebly. It is well known that as a special manure for asparagus, cabbage, and plants of a similar nature, salt acts very beneficially, and possibly it may be used with good results as a manure for some particular soil, but that it can be used to advantage, in increasing the fertility of soil generally, in the mind of the writer is extremely doubtful, though he is not prepared to say that such is not the fact. I am well aware that marine manures, such as muscle bed, eel grass and rock weed, are successfully used by farmers along our sea coast and navigable rivers, but think their fertilizing effects are dependent upon other properties rather than the salt they contain.

Hoping that wiser and more experienced minds than mine will throw more light upon the subject, I cheerfully submit this report for the consideration of the Board.

Mr. Anderson thought salt would not show so good results in Mr. Rogers' locality as it would in his own. He had seen very marked effect on his barley crop by the application of salt; also upon his mangolds. He used it at the rate of from two to four bushels per acre for barley; and a table spoonful of salt and ashes to the hill for potatoes. Upon mangolds he used it at the rate of twenty bushels per acre sown broadcast.

Mr. Goodale referred to the use of salt in the culture of the mangold, and had known it to have the best results. Indeed he thought it almost indispensable to raising a good crop of mangolds at a distance from the sea shore. Should be applied at about the rate of twenty bushels per acre, unless it is applied near the time of sowing the seed, when it should be sown in smaller quantities. Refuse salt could sometimes be obtained cheaply, and used with considerable profit.

Mr. Jaquith stated his soil to be high, dry, slaty land, and had applied salt to his pastures with a good effect, as it caused the grasses to grow luxuriantly. Had also used brine about his plum trees and received a benefit from the application.

Mr. Leach. Sowed two bushels of salt on one-half acre sowed with barley; and also sowed one-half acre of barley without the application. The barley on the piece where salt was applied was much better than that where it was not applied. This experiment was performed in 1860. The grass on the salted portion has been better than that on the part of the field unsalted.

Mr. Bigelow had made some application of salt at different times but had seen no effect from its usage. Had used it some in compost heap.

Mr. Pratt had seen salt applied to gooseberry bushes at the rate of half a pint around each bush, for the purpose of killing insects, but it did not do it, nor was it of any benefit whatever.

Dr. Weston had used a mixture of spent lime and salt to his cabbages, and it had the effect of keeping off the worms. He had also used it in forming a compost of lime, muck, ashes, &c., and it had proved an excellent fertilizer. Had used it around plum trees with good effect.

Mr. Jaquith. Had never seen a black knot on any of his trees, where he had used salt. But neglecting to apply it for a year or two it came on.

Mr. Rogers' paper was accepted, and placed at the disposal of the Secretary.

Mr. Haines of Aroostook, submitted the following paper

ON FARM STOCK.

My attention has been given to the subject of live stock breeding for more than thirty years, and in offering this paper for your consideration, I do not desire to commit the Board of Agriculture to an expression in favor of any particular breed or race, but to present, for whatever they may be thought worth, the conclusions to which, after very considerable experience, a plain, practical farmer—ambitious for no other distinction—has arrived. These conclusions have been reached by no mere theorizing or fancy scheming, nor from the persuasions of other men, but through my own careful trials of the several breeds mentioned. I had no prejudices to combat that I am aware of. If I had predilections they certainly were in favor of the breeds first proved and rejected.

In neat stock, I bred Durhams or Short-Horns, Herefords and Devons, of pure blood, for many years respectively. I have also crossed these several breeds and bred crosses of almost every grade. I prefer either of the others to the Durham, because they will better stand the rigors of our cold winters, and the short pastures of our dry summers; because they are better travellers, are more easily matched as steers and make better working oxen—(a yoke of six and a half feet Herefords or Devons will, in my opinion, perform as much work as seven feet Durhams, and be kept at much less expense.) I consider the Devons much the best of the three, as they are equally hardy with the Herefords, full as good for labor and beef, and the cows are far better milkers,—the best milker I own or know of, for her size, is a full blood Devon; her dam was the herd-book cow "Brunette II." (1825,) now on the farm of the State Reform School. Her sire was "old Winchester," got out of the herd-book cow "Fancy," (710,) by the herd-book bull "Bloomfield," (148.) This Devon cow of mine has had four calves and has been dry but eleven weeks altogether since she first came to milk. She would undoubtedly have yielded milk all the time if I had been willing to keep up her milking; and she is a marked exception to the general rule that good milkers can hardly be kept in flesh, as she is always in fine condition. Devons are also of a much more docile and quiet disposition than either of the other breeds, and the steers are still more easily matched then the Herefords, and at the same size will command a higher price than any other breed.

In selecting neat stock, I seek for symmetry of form and fineness of bone in animals of medium size,—having invariably found these to be better feeders and to pay better every way than coarse beasts. Deep chests, broad backs and full flanks, are, in my estimation, the most important points. With these I would like to obtain a barrel-shaped body, well ribbed home, rather a straight belly, a clean head and a bright eye. If these last can be got the neck will always be well enough. An animal which is narrow along the back, slab-sided, with open ribs not carried well back, and a great sack of a belly swashing about, is not a promising animal for milk or anything else, in my opinion.

By selecting with care, and a little extra cost for males, any one of our farmers may, in two or three years, double the value of his live stock. And those who thus obtain grade animals, may derive greater profits from their herds, and perhaps realize more cash annually than those who, with ten times the capital invested, are scrupulously breeding from pure blood exclusively. The infusion of fresh blood, and especially that of the strongly marked character of the pure race of Devons, brings up their herds with a jump; increasing the size and symmetry of their animals and giving them weight and beauty. It has been within my observation, that those who have these grades, obtain five dollars more a head for their yearlings than others, who have not attempted this improvement in breeding, do for those they have to sell.

In sheep, I have bred the coarse and middle wooled varieties, desiring to unite, as far as practicable, the product of wool with mutton. I have had but little experience with the finest wooled sort. Though I began with a flock of grade Merinos, and crossed thereon the Dishley or Leicester, and afterwards the South Down, which last cross made such a decided improvement that I have continued in this breed, and for some years have procured the best South Down bucks which I could find. I have proved this sort of sheep to be hardy, prolific, and excellent nurses, with mutton as well as fleeces of superior quality. More pounds of wool and mutton can be obtained from them than any I have met with. My bucks shear from eight to ten pounds, and my ewes from six to eight pounds of very nice wool, even, elastic, and of medium grade of fineness. In our section of the State (Aroostook) quite an amount of business is transacted in selling sheep to drovers. And it is found that these South Downs drive more quietly and stand their journey better than any others. Grades of this breed will dress from five to ten pounds a carcass heavier than others of the same size live weight, while the mutton is worth more a pound. In fact, as a general rule, the grade South Down lambs bring a half dollar more, and the sheep one dollar more a head than others of the same size.

In choosing breeding sheep stock I pursue the same general course as in the selection of neat stock; and am very careful to take those which have most wool on their bellies and legs; and if at any time I observe one of my sheep disposed to shed her wool, or to have bare legs and belly, I at once turn her off for mutton.

Of swine, I have during my thirty years experience bred pure blood—Mackey, Bedford, Berkshire—(of each of these two last breeds I had the first boar brought to Maine)—White, Berkshire, Newbury White, Suffolk, Essex and Chester. All these have been good breeds, and of great value in improving the swine of our State."

Mr. Anderson agreed with the reporter in many of his points, but not in all. His experience and practice had been to select animals for breeding that are more open than those described in the report. His animals had the recommendation of an eminent Short-Horn breeder of being the best herd of Devons, for dairy purposes, he had ever seen. He referred to the smallness of the bone of the animals, and considered them the best meat animals. Believed the Chester to be a better breed of swine than the Suffolk.

Mr. Haines never saw any advantage of a large belly in a cow for milk, or an ox for working. As a general thing he liked to see a straight-bellied animal with a broad back. Regarded a cross between the Chester and Suffolk as the best grade of swine for general farm purposes. Finds some difficulty in making a perfect cross between them. Preferred the Suffolk as the best breed to cross from.

Mr. Bigelow. The farmers in my section do not like the Chesters. They have too much bone and do not take on fat readily. Find it difficult to cross them perfectly—some will be all of one kind. Regards the old Newbury White as the best breed ever imported into Somerset county. Wherever they are found you will find good hogs.

Mr. Pratt did not like the Chester Whites. Preferred a cross of the Suffolks for a hog that is to be slaughtered when eight months old.

Mr. Rogers spoke favorably of the old Newbury Whites, and concurred with the gentleman from Somerset.

Mr. Haines gave an account of the old Newbury White breed. They were introduced by Dr. Vaughan of Hallowell, under the name of "Byfield." They were the only pair of pure Newbury Whites ever brought into Maine to his knowledge. They had small ears, short legs, and long bodies.

Mr. Bigelow said the Newbury Whites were introduced into Somerset county by Mr. Coburn, father of Ex-Governor Coburn, he obtaining them of Dr. Vaughan. The "Bedfords" were introduced by Dr. James Bates, formerly of Norridgewock.

After some further discussion, the paper was accepted, and left at the disposal of the Secretary.

In this connection, is submitted a memorandum furnished by Hon. S. F. Perley, regarding the gain in weight of several animals, while at pasture, only during the past season:

"Ayrshire bull, 12 months old, from May 2d to Nov. 11, 200 days, gain,	328 lbs.
" heifer, 13 " " " " "	280 "
Heifer, cross of Jersey and Ayrshire, 16 months old, from May 2d to Nov. 11, 200 days, gain, ...	275 "
Grade Devon heifer, 12½ months old, from May 2d to Nov. 11, 200 days, gain,	151 "

Average of the four, 258½ lbs.

Grade Devon steer, 2 years old, during same time, 200 days, . .	**140 lbs.**
" " " " " "	**177 "**

Average, 158½ lbs.

Pastures rather bushy, and feed rather short."

Mr Pratt presented the following paper

On the Culture of Small Fruit.

As a people we are so much engaged in the accumulation of wealth that we are constantly looking out for the main chance; and to such an extent has this become the case that we sometimes overlook some of the smaller things that would not only help us to secure the desired object, but contribute more to our happiness than the mere acquisition of wealth. Among all the pursuits in which we are engaged, and which contribute to our wealth and happiness, none, we think, is less appreciated than horticulture. And a comparison of this with other industrial pursuits will prove the position. In the year 1847 estimates were made by Mr. Burke, the Commissioner of Patents, showing this interest to be of more importance than has been generally supposed. A comparative statement of the different interests in this place, may not be wholly uninteresting. The whole products of the soil, in round numbers, were $1,144,982,240, while all other pursuits produced but $593,797,735.

The following are some of the leading products, viz: Corn, $215,740,000; wheat, $137,094,600; hay, $106,559,200; cotton, $72,905,000; dairy, $41,220,149; horticultural productions, including orchards, nurseries and gardens, $54,577,533, divided as follows, viz: orchards, $8,853,422; nurseries, $724,111; gardens, $45,000,000. It will thus be seen that horticulture, in its various branches, produces more than the dairy, two-thirds as much as the cotton, and more than one-half as much as the hay crop. The Commissioner estimates five persons to a family, and three gardens to every four families, producing fifteen dollars each, which would give in the aggregate, $45,000,000. Maine, according to this estimate, would have 120,000 families, 90,000 gardens, producing $1,350,000, giving two dollars twenty cents per head for garden products, which amount we think would be consumed if raised in sufficient quantities; and no one we presume will doubt that we can and ought to raise this, or even more, with but little interference with other pursuits. But suppose we estimate the gardens of Maine at one-half of this number, or three for every eight families, we shall have $675,000, or one dollar and ten cents per head, to consume of garden products. If the estimates of Mr. Burke are correct, that as a nation we consume two dollars and twenty cents per head of these products, and as a State we are producing but half of this amount, then we are sustaining a loss which we cannot well afford.

How this amount should be divided between the vegetable and fruit garden, we are unable to say, but are inclined to believe that one-sixth part of this amount given to small fruits would be a fair estimate, which would give in the aggregate $112,000, or about eighteen and three-quarter cents per head, which amount may be doubled, or even quadrupled, and still leave us unsupplied with these fruits.

In the early settlement of Maine the cultivation of fruit was confined principally to the apple, pear, plum, cherry and currant, from the fact that our pastures and fields produced the strawberry, raspberry, blackberry, and some of the other small fruits, in such abundance that any effort in that direction became wholly unnecessary. But a change has come over us. Our soil has become so impoverished that it neither produces them to such an extent or of such fine quality as formerly, (except in the newly settled portions of the State,) and not only that, but hosts of enemies have arisen up to destroy and devour. The cherry and plum have been given up in a great measure, in consequence of the black-knot and curculio; and the currant and gooseberry are suffering to considerable extent from the currant worm and other insects. Thirty years since, the cherry was produced so easily in Androscoggin county that many farmers raised not only enough for their own families, but in sufficient quantities to supply nearly all of their more unfortunate neighbors.

The plum was also raised to considerable extent. We even now obtain the strawberry, raspberry and blackberry, in considerable quantities from our pastures and fields, but as a general rule at a greater cost than we should incur by their cultivation; besides we lose the pleasure which can only be derived from eating one's own productions. Every man who owns one-half acre of ground can supply a family of five or six persons with nearly all the fruits adapted to our climate, besides having sufficient room for a vegetable and flower garden, and unless his buildings are of unusual size, if we except the apple, a much smaller space will suffice; to prove which I will cite an instance which has come under my own observation. I refer to Mr. E. P. Tobie of Lewiston, who owns thirty square rods of ground, about one-half of which is occupied by buildings and flower garden, from which he furnishes a family of three or four persons with all they need during their season, and a good supply for winter's use, of strawberries, raspberries, currants, gooseberries, grapes and plums, besides tomatoes, beans, melons, rhubarb, lettuce, &c. He has also some half dozen dwarf pear trees, which have nearly recovered from the effects of the winters of 1856 and 1857, from which he may reasonably expect several bushels of pears yearly. Mr. T. sells from this small spot of ground, with the aid of a small hot-house, more than one hundred dollars' worth annually. Some years he has sold twenty-five dollars worth of grapes, with only three of the most approved sorts of vines in cultivation, and those quite young. The inquiry then arises, if the small fruits are so easily cultivated, why they are not more generally produced, not only by *all* our farmers in the older portions of our State, but by every person who owns a few rods of ground, no matter what his calling may be, especially clergymen, mechanics and merchants, who so much need the exercise it would give them, to say nothing of the satisfaction they would derive from eating fresh fruit of their own raising—a pleasure that no one can properly appreciate unless he has experienced it. Farmers should cultivate them not only because they can do so as cheap or cheaper than they can obtain them in the usual way, but because they will contribute to the health of their families, and give the younger members a pleasant change from the more arduous and less pleasing labors of the farm. If it was the rule, instead of the exception, to have well managed flower, fruit and vegetable gardens, I think we should see less disposition on the part of our young men to leave agriculture and its kindred pursuits, for less laborious, and perhaps more lucrative employments, but which are far more dangerous in their moral tendencies. If the small fruits can be cultivated with advantage to our health, purse and happiness, then a few general hints as to the manner of their cultivation, &c., may not be wholly unprofitable.

Strawberries. Strawberries are, perhaps, the most popular of all our small fruits, being the first to make their appearance in the spring after a long winter, during which we have been deprived, in a great measure, of all the small fruits, we are apt to look forward to their appearance with the greatest pleasure. After enjoying their delicious flavor for a few weeks, our appetites become, in a measure, satiated, so that perhaps we do not appreciate some of the other small fruits so highly as they deserve. It seems strange that the cultivation of a fruit which is generally esteemed so healthy, so easily raised, and commanding so high a price in our markets, should not be better understood and more generally practised. That it is highly esteemed, needs no better proof than the demand for it in all our large towns and cities, not only in our own State but throughout the country. The market of Philadelphia alone requires fifteen thousand bushels or more.

Mr. Downing says of it, that it is the most wholesome of all fruits, being easy of digestion, never growing acid by fermentation as most other fruits do. I believe any individual who owns three or four rods of ground on which the sun shines, and who knows enough to raise a hill of corn or potatoes, may raise enough, at an expense not exceeding six cents per quart, to give a family of five or six persons not a stinted allowance, but as many as they will generally desire during their season, and as many as will be usually wanted for winter.

The most common method of cultivation is to set the plants, allowing the runners to take root, which will almost preclude the use of the hoe, and the consequence is, that the bed is so soon overrun with plants and weeds that it is about impossible to clear it out, and there it remains until the patience of the cultivator is so exhausted that he becomes disgusted with his own efforts and strawberry culture in general. In such cases one full crop and a half is as much as is usually obtained. The best method that I have seen recommended, and one that corresponds with my own experience, is to take any good soil and spade in a good coat of well rotted manure and ashes, and if it is a compost of stable manure and leaves or muck properly prepared, so much the better. Three plats of ground should be laid out of sufficient size for the use of a family, in beds five feet wide, with alleys two feet wide. A row of plants should be set in the middle of the bed, and one on each side six or eight inches from the paths, setting the plants eighteen inches apart in the rows. The plants can then be taken care of and the fruit picked from the alleys. The runners should be cut three or four times during the summer. Strawberries cultivated in this way need to be mulched not only to ensure them moisture enough during the season of fruiting, but to protect the roots from the ill effects of freezing and thawing, but care should be used not to give the crown of the plant too much covering during the winter, as there is nearly as much danger from over-protecting the crown as from a lack of protection. The finest fruit may be expected from this mode of cultivation, as the energies of the plant are not exhausted in the production of runners, and it affords a plenty of light and heat both, which are so essential to insure the best of fruit. It is a mistaken idea that our wild strawberries are of finer quality than cultivated, and no one who has eaten a good ripe Hooker or Triomphe de Gand will dispute the assertion. By pursuing the above plan, planting one-third yearly, an individual will obtain two crops from his plants before they need renewing. Some assert that by this method the plants may be kept in bearing five or six years. If this, on trial, should prove to be the case, they will not need to be renewed so often. Various lists have been recommended for cultivation, but none can be strictly relied upon for this State, unless they are made by one who has had some experience, and then they may not be adapted to every locality, and what is now considered best may not be so a few years hence. No one who knows the improvements which have been made in the strawberry within the past few years, will hardly dare to predict how far this improvement may be carried. Wilson's Albany is probably the best for general cultivation in this State, being an excellent bearer, and is of good quality if allowed to ripen sufficiently. I have raised eighty quarts from a piece of ground one and a half rods square. I regard the Jenny Lind as second only to Wilson's as a bearer, and of better quality. My experience with the Triomphe de Gand is too limited to speak with any degree of certainty as to its merits; but with what I have had I would place it third on the list for general cultivation. It is superior to the others in quality, and if it should prove as good a bearer,* will take a higher stand than either of them. The Jenny Lind will ripen first, Wilson's next, and the Triomphe de Gand last, which will prolong the season as long as any list of good strawberries that I know of now in cultivation, and will give as many kinds as will be desirable for garden culture.

---

* It has generally, in this State, proved very unproductive. S. L. G.

Raspberries.—No fruit, except the currant and perhaps the gooseberry, can be so cheaply raised as the raspberry, and yet no fruit adapted to our climate and garden culture is so much neglected. Comparatively few attempts have been made to cultivate them for market in our State, or at least few have come within my knowledge, our supply coming principally from the pastures and fields, which supply is somewhat precarious; besides, for home consumption it is procured at too great a cost. I have raised this year from less than four rods of ground four bushels of fruit, which did not cost me one-third of the value of the fruit. The raspberry, like most of our small fruits, has been much improved within a few years. Dr. Brinckle of Philadelphia, has done more, perhaps, than any other man, to improve this fruit, having given us some of the best varieties now in cultivation, if not the very best, and what has been said of the strawberry may also be said of this, that it is difficult to tell how far this improvement may be carried.

Raspberries will grow on almost any good soil, but flourish best on a moist soil containing considerable vegetable mold. For garden culture, after spading in a good coat of well rotted manure and ashes, mark off your rows four feet apart, and if you have plenty of room, five is better, setting the plants two or three feet apart in the rows; in either case they will, if well mulched (which I consider almost indispensable), soon fill all the intermediate space. A plantation of raspberries will need but little care for five or six years, except thinning out, so that the plants shall stand about a foot apart—tying up and heading in about one third the length of the canes in the spring; laying down and covering in the fall with evergreens, leaves, or anything that will shield them from the effects of the sun when they are not covered with snow. If kept well mulched they will produce much better fruit and require but little weeding, and that can and ought to be done with the hands, on account of the roots running near the surface of the ground.

Brinckle's French I consider the best for all purposes. It is hardy, productive, and the best flavored berry that I have ever seen. No garden should be without it. Brinckle's Orange stands next in point of flavor, is productive and hardy, is not a good market berry, but is the best I have seen for preserving in the old way of using equal weights of fruit and sugar. The Franconia is an excellent market berry, a superior bearer, very hardy, and if of as good flavor should prefer it before the Orange. The Black Cap is an excellent bearer, hardy and one of the best for cooking, and is not so highly prized by cultivators as it ought to be. It requires a great deal of pruning to obtain the best of fruit. I have picked from one bush between six and seven quarts for three years in succession.

I have tested the above list together with some other varieties for six years, and have never failed of a good crop or lost a single cane by winter-killing.

Grapes.—Such rapid improvement has been made in the grape within the past fifteen or twenty years, that we confidently look forward to the time (and that not far distant) when the grape shall be as sure a crop and as generally cultivated as any of our small fruits.

Within the period mentioned, the Isabella was considered our best grape, but it would scarcely ripen in the very best situation. Years after the introduction of the Isabella came the Diana, Concord and some others which were perhaps a little earlier. Next came the Muscadine and Hartford Prolific, which were decidedly in advance of either of the others in point of ripening, but not in quality. The last grape introduced which has gone into cultivation to much extent, is the Delaware, and, all things considered, it is the best grape for out-door culture, which we have tried in Maine. With the experience and observation I have had, I should recommend for out-door culture in this State, the Delaware, the Hartford Prolific, and Northern Muscadine. The next most important point after securing good varieties, is location, which should be such as to protect them from the north and west winds, and secure the rays of the sun all day if possible, or at least two-thirds of the fore part of it. The best Clinton grapes I ever saw were grown in a deep gully, the vine being allowed to run up on the bank without any care at all. But this course will not do for garden culture. I think most cultivators allow their vines to run over too much surface. Vines should be pruned immediately after the fall of the leaf, as they are sometimes apt to bleed if pruned very late. It will also be found necessary to lay them down during the winter, covering them with evergreens, forest leaves, or something of the kind.

Gooseberry.—Our climate is as well adapted to the cultivation of this fruit, perhaps, as any portion of our country, it being found wild in nearly all our low lands, is perfectly hardy, and bears well when the fruit is not destroyed by insects or mildew. Many foreign kinds have been introduced, but all, or nearly all, have had to give place to Houghton's Seedling, on account of their liability to mildew, this being almost entirely free from that defect. Its origin is interesting, and we copy the following account of it from the *American Agriculturist:*

"Some thirty years ago, Mr. Abel Houghton, then of Lynn, Mass., set out in his garden four of the best English sorts, in a circle, with a native variety in the centre. They all flowered and fruited the second year. He sowed the seeds indiscriminately; when the seeds came up, he transplanted them by the hundred into rows. In five years they came into bearing, but nearly every one suffered from mildew. He saved the best, and threw away the worst, and finally the kind known as Houghton's Seedling was the only one that proved worth saving and propagating. For his trouble he got nothing but the honor of having introduced the best gooseberry in cultivation."

As a grower and bearer it excels all other kinds which have come under my observation. Large crops may be expected from this fruit on rich, moist soil, if properly pruned, which will be almost indispensable to secure the best quality of fruit. This berry suffers from the currant worm to a large extent in some localities.

Currant.—The currant has been more generally cultivated than any of the small fruits, for the reason that it has had but few enemies, is perfectly hardy, and bears some fruit under almost any treatment. Yet it pays as well as almost any other fruit for good cultivation.

Currants may be trained in almost any form, either as a bush or tree; in either case generous manuring and thorough pruning will pay. Those individuals who have now an unsightly mass of bushes will find it greatly to their advantage to cut from one-third to one-half of the oldest stalks, and all of the small sprouts, leaving some of the large ones to take the place of those that will be cut out from year to year.

The varieties I have grown are White Dutch, Victoria, and Knight's Large Red. The first is a slow grower, but produces a good crop of first rate fruit. The Victoria is a vigorous grower, a good bearer, fruit hangs on late and is of fair quality. Knight's Large Red is a remarkably good grower, and produces an abundance of large fruit, of fair quality, but is apt to fall soon after ripening.

The currant worm is so destructive in some localities that cultivators have become almost discouraged in trying to raise this fruit.

Blackberry.—This fruit on newly cleared lands grows wild in abundance, and is really one of the best of our small fruits, but it is doubtful if it can be cultivated with profit for market or with pleasure in our gardens, unless one has plenty of room and an abundance of patience which he is willing to sacrifice to this really disagreeable bush but delicious fruit. It requires about the same treatment as the raspberry, except that the plants should never stand nearer than five or six feet. The best kinds in cultivation are Dorchester high-bush and Lawton.

Plum.—The plum has been very much improved in quality, but is little cultivated in this State, owing to the black knot and curculio. In the vicinity of Bangor it seems to flourish, and perhaps some other places, but is considered an uncertain crop.

Cherry.—The cherry does not flourish now as formerly; very few efforts are made in the vicinity of Androscoggin County to raise this fruit, owing chiefly to the black knot and curculio. Within a few years some have been raised for market, but to a very limited extent.

Cranberry.—The cranberry may be raised on our bogs and meadows to a large extent when their cultivation is better understood and farmers have a little more courage to enter into a paying enterprise. Some have cultivated them on upland, but to a limited extent. The Agricultural Society of Androscoggin County have paid premiums almost every year since the society was organized for cranberries raised in this way."

Mr. Rogers inquired regarding the experience of other members with grapes for open culture.

Dr. Weston in reply said that some kinds were attempted to be grown here which were too late to ripen well. This was the case with the Isabella in his vicinity, unless it had a very sunny exposure, protected and judiciously pruned. The Delaware, although small both in the size of the berry and bunch, had proved successful in Bangor. The Hartford Prolific would grow anywhere and ripen its fruit, if judiciously cared for. The Rebecca is not so hardy as the others, but is a good berry. The ends of the shoots are apt to winter kill. The Diana has also ripened, but he could not recommend it for general cultivation; should be trained against the wall of a house on the sunny side. In regard to pruning, much depends upon the space they are to occupy. In a small space they should be pruned so as to form a simple cane. Prune the laterals in autumn to within three buds of the cane, and in spring leave the one nearest the main cane, rubbing off the other two. An error is often made in cutting off the foliage to ripen the grape. It is a wrong practice. Should not let vines grow higher than six or seven feet; should not let more than one or two bunches of fruit grow upon one spur; thin out the remainder; cut off all runners when thinning out the fruit. Manures for the grape should be composted before being applied. Regards three hours of morning sun worth all the afternoon sun, consequently prefers eastern rather than a western exposure.

The Secretary remarked that the Delaware, Hartford Prolific, and Northern Muscadine had proved to be the three best grapes for out-door culture in Maine which had yet been fully tested.

Doubtless we should some day obtain better grapes than any now known. The way to get them was to grow seedlings from the best and earliest we have. A very small proportion of the seedlings would be good for any thing, but perhaps one in a thousand would be a great prize and worth all the trouble attending the growth of ten thousand worthless ones. A grape as handsome and hardy as the Concord, as good as the Delaware, and as early as the Old Colony, would be worth hundreds of thousands of dollars to Maine. Did not think so highly of the Diana as formerly. It had been subject to dry rot of late. Uses animal manure but sparingly, and only when well composted. Ground bones and ground oyster shells form a good application for vines. The great secret of grape growing in our climate is to get well ripened shoots and to thin out the bunches sufficiently as soon as well formed.

Mr. Dill found the Hartford Prolific to ripen well as far north as Phillips, and had proved the best of any yet tested with him.

In this connexion it is deemed proper to report some remarks made regarding orchard fruits by various cultivators at an informal meeting; and chiefly such as give facts additional to, or views differing from those presented in the Secretary's report of the past year on the same subject.

Blue Pearmain.—Dr. Weston said it succeeded well near Bangor with rich culture. Tree hardy and productive.

Mr. Chamberlain said it was a good bearer in Piscataquis County.

Mr. Foster. A light bearer in Kennebec County and unprofitable.

Mr. Pratt. A sly bearer in Androscoggin.

Mr. Jaquith of Kennebec. Would not recommend it for orchard culture. It succeeds well in gardens.

Mr. Dill. On high farms in the northern part of Franklin County is a very good bearer and very hardy.

Mr. Russ. It sells better than any other in Farmington. Is a good bearer and keeps late.

Northern Spy.—Dr. Weston. About Bangor this variety bears at an earlier age than in some other parts of the State; remarkably hardy; bears every year; fruit keeps late, and is one of the best sorts for Maine.

Mr. Foster. With me this tree contradicts its general character; is a good bearer; needs high culture.

Mr. Jaquith. Succeeds well in Albion; keeping qualities inferior to Rhode Island Greening.

Mr. Pratt. Late in coming into bearing.

Mr. Gilbert of Greene. Did not dare to recommend it for extensive culture; requires a fine, deep, moist soil and high culture; keeps until August and holds flavor well.

Old Nonsuch or Red Canada.—Dr. Weston. Tree healthy, good bearer; fruit nice and sells well; not spotted.

Mr. Goodale. Is not profitable for general culture. In some parts of Penobscot County the soil and climate seem to suit it; in the western part of the State the tree is unhealthy and fruit liable to blight.

Mr. Chamberlain. With me the tree is hardy.

Mr. Wingate of Hallowell. Entirely worthless with us.

Mr. Foster. Will keep fair until July; tree is liable to canker; not of much value.

American Golden Russet.—Mr. Foster. Tree hardy, good bearer and good grower; liable to overbear.

Mr. Rogers. Produces abundantly in the vicinity of Topsham.

Fameuse, or Snow Apple.—Dr. Weston. This apple originated in Canada; it exhibits the same good qualities here that it has in Canada.

Mr. Goodale. Is worthy of more general culture in Maine;

tree very hardy; will grow as far north as any sort; abundant bearer; is not of large size, but very juicy.

Mr. Jaquith. Is very hardy, very productive, and very uniform in size.

Mr. Haines of Aroostook. The tree bears every year with us; at Fort Fairfield it succeeds well.

Black Oxford.—Dr. Weston. Is not extensively grown in Penobscot County; keeping qualities superior; valuable for cooking.

Mr. Pratt. Tree hardy; liable to overbear.

Mr. Chamberlain. Hardy; good bearer.

Mr. Foster. Is not much esteemed with us; keeping qualities superior.

Mr. Gilbert of Greene. This apple originated in Paris, Oxford County; is not first class; will not keep better than the Greening.

Yellow Bellflower.—Mr. Foster. With good culture is a good bearer; would recommend it for high or garden culture.

Mr. Anderson of Windham. It bears wonderfully with me, and the trees much neglected.

Mr. Foster. The tree is inclined to send out too many limbs.

Mr. Goodale said the tree might be considered a capricious one as it often failed or succeeded from causes not obvious.

Mr. Wingate. Tree requires a rich, deep, sheltered soil; is liable to split down.

Mr. Pratt. Tree a shy bearer; is liable to split down; fruit needs to be handled with great care.

Gravenstein.—The Secretary inquired of those present whether their trees of this sort suffered from a canker in the wood, to which he had alluded in describing this fruit in his Report. None had seen it. Messrs. Weston, Pratt, Jaquith and others said it was healthy and unexceptionable in every respect.

Mr. Nickerson of Readfield, being called upon to give an account of his seedling pear, said it was grown from seed first planted by Ex-Governor Hunton in his garden in Readfield, and from thence transplated to his own. It had little care taken of it, but grew well, and in 1860, being about seven inches in diameter, bore three barrels, which sold for $12,50 per barrel. It was very hardy. Of hundreds of scions set he never knew one hurt. It unites with the Thorn and with the Mountain Ash.

Mr. Foster said it grew well with him on the quince stock, but he had not yet fruited it.

The Secretary read the following communication from S. F. Perley, Esq., Ex-President of the Board, which is valuable and interesting from the *facts* stated both regarding the profits of orchard culture and the effects of sheep-grazing:

The following is a current account with Field No. 9, an apple orchard of four acres. The trees were set about fifty years ago, twenty-five feet apart; (they are too close by ten feet.) There are now 280 trees in bearing condition. Pastured with sheep eight years past:

1862.	Dec. 31.	Field No. 9 by 475 bus. hand-picked apples, 40 cts.,	$190 00	
		" " 230 " windfall " 20 "	46 00	
		" " pasturage of sheep,	10 00	
				$246 00
		To labor pruning, &c.,	$2 30	
		" gathering fruit,	27 65	
		" interest and taxes on $400, 8 per ct.,	32 00	
		Net profit,	184 05	
				$246 00
		Field No. 9 Creditor.		
1863.	Dec. 31.	By 600 bushels gathered fruit, at 75 cents,	$450 00	
		By 425 " windfalls, at 35 cents,	148 75	
		By pasturage of 20 sheep,	10 00	
				$608 75
		Same Debtor.		
		To expense of pruning, grafting, &c.,	$8 80	
		" gathering fruit,	39 35	
		To interest and taxes on $500, 8 per cent.,	40 00	
		Net profit,	520 60	
				$608 75

The price of apples in 1863 was favorable and the quality of the fruit unusually good. The proportion of windfalls in this year was large, owing to my absence just at the "nick o' time," and to the heavy fall gales. The orchard is manifestly improving under the treatment, *sheep-grazing.* Eight years ago it would carry but eight or ten sheep, and last year about twenty; *then* it bore about 100 bushels apples of poor quality—*now* from 700 to 1000 bushels of fine fruit.

If the above will do you any good in your discussions, use it at your discretion. There is no guess-work about it, but taken from my farm journal as kept from day to day.

At another informal meeting, the subject of Marine Manures was discussed, and some important facts being elicited, it is deemed proper here to introduce a report of the same.

Hon. Mr. Merrow of the Senate being called upon to preside, took the chair and submitted some general remarks on the use of Marine Manures. Farming was not his leading business, but he did something at it, and had found that plenty of manure was indispensable to success.

Wm. D. Dana Esq. of Perry, being called upon for his experience, said: "About all I know of marine manures is this: Rock weed, muscle bed and pogy chum will make grass grow. Our seaside farmers do not appreciate their privileges, and there is not half the use made of marine manures there might be. The best use we can make of herring after they have been pressed for the oil is to pass them through the bodies of sheep. The sheep get fat on them, a good growth of wool is produced, hay is saved, and the manure is in an excellent state for the land."

Dr. Weston read the following communication which had been given him by Mr. Dana:

Feeding Fish Offal to Sheep.

"Necessity is the mother of invention," and sometimes of discovery also. Farmers in the eastern part of the State have for the last two years had need to apply this saying in devising ways and means to save their flocks and herds. The hay crop of 1862 was less than half a fair average crop, and that of 1863 still less than its predecessor; and the problem to be solved very generally was how to winter such stock as must be wintered. The usual substitutes, roots and grain, were as scarce and high in proportion as hay, and to buy either hay, grain or roots at present prices, for feeding stock, would cost more than the animals would sell for in the spring. This state of things has caused almost an indiscriminate slaughter of old and young. Most farmers have reduced their dairy stock to the lowest number necessary for their own supply, sent their young steers and heifers to the butcher, and their working oxen and milch cows, with their swine, to the sausage mill. Sheep have gone in droves to Brighton, and the bales of pelts seen on the steamers testify to the necessity of the region in regard to forage. Now out of this necessity comes the knowledge that the sheep is an omniverous animal, living not upon vegetables alone, (and the same probably will be found true of other animals besides the sheep and hog,) but greedily eating and thriving upon animal food as part of its diet: and the statement sometimes made, that farmers on the coast send their cows out fishing and feed them on what they catch, comes nearer to the truth than many suppose. Some farmers or sheep-owners on the coast and islands leave their flocks to provide for themselves—and they live through our winters on such fodder as the seashore furnishes—and other farmers at a distance from the shore go there to seek food for their cattle as well as for themselves.

Fish pomace or the residuum of herrings after the oil is pressed out, is greedily eaten by sheep, hogs and fowl. Probably pogy chum would be eaten as well. Smoked alewives and frost fish also furnish a food palatable to cattle. The fact of animals eating fish being established by ample trials, the question comes next, what is the effect of such food upon the system? In the region alluded to, the seaboard towns of Maine, large quantities of this fish pomace and refuse fish are used as manure, usually as top dressing for grass, and flocks of turkeys that feed upon these fields get fat and *fishy*. Pork, so fed, will grow and get fat and be very nice, for those who like train oil. Sheep also thrive well, get fat and yield heavier fleeces than when fed on anything else produced in that region. Probably linseed or cotton seed oil cake itself is not more rich in the elements of wool and flesh than this *animal* oil cake. What its effect may be upon the flavor of mutton, is among the things yet to be determined—as also its comparative value as an article of food. Careful and close observing farmers who have fed it assert that it is of equal value with good hay, ton for ton, and that its value for manure is in no degree diminished by passing it through the living mill, and thus reducing it to a much more convenient state for applying.

An objection to its use on a large scale is found in the fact that it soon gets "rank and smells to heaven," or at all events over a considerable portion of one's little share of earth. But sheep seem to be no way fastidious, and ask no questions about the freshness of the fish. For manure it is dried and mixed with other ingredients. If it could be sufficiently dried, without other substances, to prevent putrification, it would form a valuable article of cattle feed in regions from which it is now excluded by the expense of transportation and its own odoriferous nature."

The Secretary remarked at some length upon the importance of the fact communicated by Mr. Dana. By this method we get a threefold return from the fish instead of a single one as formerly. First, there is the oil, a valuable article of commerce, for which alone the manufacture was long and profitably carried on, and now we are informed that the pomace is an acceptable food for sheep; and it is very certain that after the product of meat and wool is obtained, we have a most excellent remainder of manure. Our seaside farmers have not yet learned the value of fish, and do not sufficiently appreciate or avail themselves of their manurial resources. At Treat's Island, near Eastport, some 150 or 200 tons of fish guano is made annually, but it nearly all finds a market among the farmers of Connecticut.

If sheep eat the fish pomace freely, doubtless much poor hay or straw can be used with it to good advantage, thus allowing the farmer to use all his good hay in keeping other stock. Mutton fed in this way might be too high flavored to be agreeable, but he could not see that it would injure the wool; nor the meat either, if other food was substituted for a proper length of time before slaughtering.

The effects of marine manures vary in different localities and soils, and much also depends on the season. After using sea weed on the same land for a number of years, not so much effect is seen as at first. In dry seasons muscle bed does but little good; in wet seasons its effects are more marked, and it generally gives good satisfaction. He had seen the effects of an application of muscle bed to soil a distance of fifteen miles from the coast, and after an interval of twenty-eight years, a marked difference was to be observed in the amount of grass growing upon the land in wet seasons.

Mr. Thompson of Stockton, had used rockweed, but had seen no beneficial results therefrom. He had also bought fish pomace and used it, but thought he did not get his money back. Had applied fish to land as a top-dressing at the rate of 10 barrels upon one third of an acre, raked in among the grass roots, and next year the grass was of a very rank growth. Last year he cut about three tons to the acre from this land. The price per barrel in his section was 87½ cents. Would recommend about fifteen barrels per acre as a top-dressing. Had noticed cattle loved the grass as a fall feed, upon which fish guano had been applied. His soil was a stiff clay; would bake when thrown up wet.

Col. Chapman, Land Agent, said that in the town of Bristol little use was made of muscle bed, and its use had not been very satisfactory. In Newcastle Centre there was a ridge of land of fine loamy soil free from rocks, between the marshes, which had been settled since 1630, upon which marsh mud had been used with very decided results. It was hauled upon the fields in the fall, and also placed in barn yards. Farmers kept their stock on salt hay, selling their fresh hay, and keeping up the fertility of their farms by using marsh mud. He stated an instance of the use of a compost made of marsh mud, unslacked lime, swamp muck, rock weed, &c., applied to a field, (the soil of which was a gravelly loam) in the spring upon the furrows, and harrowed in, the field being sowed with barley, and an excellent crop was the result. At Wiscasset, farmers make considerable use of rockweed with good effect.

Mr. Pratt gave the results of an experiment with sea weed in manuring potatoes that showed very marked results. He obtained two barrels from Mr. A. Johnston of Wiscasset, and applied it in comparison with ashes upon soil that had not been plowed for sixteen years. Spread on stable manure at rate of 20 cords per acre, and plowed it under eight or ten inches deep, planting with potatoes three feet apart in the row, and eighteen or twenty inches distant in the hill, with the following result:

Row	No. 1.	No manure	in hill	produced	133 lbs.—71	bushels.
"	No. 2.	Ashes	"	"	152 lbs.—81	"
"	No. 3.	Rockweed	"	"	184 lbs.—98	"
"	No. 4.	Ashes and Rockweed		"	183 lbs.—97½	"

It was not a favorable season. An application of six hundred pounds of rockweed per acre gave an increase of fifty bushels. The rockweed was applied in a finely pulverized state.

Hon. Mr. Noyes of Hancock County. Had used muscle bed upon a limited scale. Always plowed it in, and had not failed in a single instance to get a good crop. It is better and cheaper procuring it in summer by boats, than in winter on the ice. Had tried it as a top-dressing on grass land, but saw no effect from it upon clayey soil or clay loam. Believed it should be composted with muck, loam and stable manure before using it.

Mr. Wasson of Hancock, mentioned an instance where muscle bed had been applied to a clay loam in Surry for ten or fifteen years, and had produced great crops of hay during that time, but for the last five or six years it has not been used. It formerly cut from three to three and a half tons per acre, but last year nothing grew on the field where it had been applied but rattle-weed. Where it had been applied on the surface nothing would grow; but if plowed under it produced good crops of hay. It had proved of no value unless it had been frozen. In one instance it was applied to a field where no herdsgrass had been seen for years, and after its application the herdsgrass grew largely. He spoke of the value of the water expressed from the fish in the process of extracting the oil. This is commonly thrown away, but it is a valuable fertilizer. It demanded more attention than had been given it.

The Secretary said it was not uncommon to hear people assert confidently that a large application of fish, or of guano or other active, special manure, eventually damaged the land to which it was applied, when the fact was, that the large crops which followed the application exhausted the soil by drawing from it a good deal not in the manure applied, and which another dose of the same manure would not make good. It was not what was put on, but what was taken off, that exhausted land. With plenty of marine manures it was easy to put land into a highly productive state, but to keep it so the manure made by consuming the crops should be given back to it.

The Secretary read a communication from Mr. Roberts of Cumberland County, as follows:

Muscle Bed as a Fertilizer.

Muscle bed is deposited in the bays and inlets on the coast of Maine. There are large quantities of it in Casco Bay; and many of the farmers on the coast depend upon that and other marine manures as a fertilizer for their farms. The high price of land, and the facilities for shipping hay to Boston and other markets, make this a valuable privilege, and if carefully collected and intelligently used, will give the coast farmers of Maine a great influence on the hay markets of New England. It enables them to put a much larger proportion of their land into mowing than can be done on stock farms; and although muscle bed is not equal, in all cases, to stable manures, the privilege is great to have such a *bank* in the vicinity of the farm for the farmer to *draw* from at his leisure.

The methods of getting it are two—by gondolas or flat bottomed boats in the summer, and by cutting through the ice in winter and hauling it directly to the field. This is considered by many the cheapest way of procuring it; but the time it is frozen sufficiently hard to bear the teams is so short in each year that it is an uncertain way of getting it, as some winters they cannot go on with teams at all. The best mud lays at extreme low water mark and cannot be got only at the high run of tides at the new and full moon. Large loads can be drawn on the ice to the shore, where the load is usually divided, making two or three loads to the farm. Some farmers, living on the shore near the muscle beds, load four or five sleds at a tide, draw them to the shore before the tide rises much, when they can take them to the field at their leisure.

The gondolas carry from four to six cords. Three men will load and unload them at a tide. The mud is brought in them to the landings on the farms, or to wharfs as near to them as the boats can get. The usual price for boating it is from one dollar and fifty cents to two dollars per cord. Its weight—six tons per cord—forbids its being carried inland very far. I have usually paid one dollar per cord for drawing it from the wharf to my field, a little over half a mile, and that is as cheap as it can be done under the most favorable circumstances.

The method of using it is as a top dressing for grass and grain. It is never worked in deeper than with the harrow or cultivator, and the farmers who have had the most experience with it consider that the nearer it is kept to the surface the better; and even prefer to put it on to the stubble where the land was seeded to grass in the spring, to harrowing it in with the grain, notwithstanding its excellency for the grain crop.

I have seen instances where it had been applied on old greensward, and a year or two after the land was broken up. In the crops that followed no difference could be perceived where the muscles were put and the other parts where no manure whatever had been used; the land all receiving an equal quantity of stable manure after ploughing. But as soon as the muscles were brought to the surface again by the plough, their efficiency was readily perceived.

When first taken out muscle bed is adhesive, somewhat like blue clay, and *must* be frozen before it can be spread on the land; otherwise it remains in lumps, will bake very hard, and be of no use to vegetation; but it slacks up fine after being frozen, when it can be spread as readily as any manure.

It is on moist, clayey loams where the greatest benefit is derived from it. It does well on *all* clayey soils, and on sandy loams if not too dry and light. But on dry, sandy plains, or gravelly knolls—so far as my experience and observation go—it is not worth carting forty rods. On such land a small benefit would be derived from it to a crop of grain, and it might be perceptible also after a first crop of grass, after which no effects would be seen at all.

The quantity used per acre varies from eight to twelve cords. The general opinion is, that more than twelve cords per acre at one application is injurious rather than beneficial for the first two or three years after it is put on. Ten cords per acre on clayey loam land which has been run out, as it is termed, will usually produce a *good* crop of grain, and from one and a half to two tons of hay per acre for several years, provided the seasons are favorable. I make this proviso, for there is no manure with which I am acquainted, that the seasons make so much difference with, as with this. The most remarkable proofs of this which I have known occurred on the farm of Capt. J. M. Bucknam of Yarmouth, whose farm lies very near the muscle bed, and on which it had been used in large quantities for many years. A few years since, his hay crop was reduced in one year by the drouth, from seventy-five tons to twenty-eight tons. And again in 1859, or 1860,* the hay on the same farm was reduced from sixty tons to eighteen tons, and the grass roots very badly killed. In such fields where the grass roots suffer so much, they do not recover and resward the land so readily as on fields dressed with stable manures. All farms that are dressed principally with muscle bed suffer great diminution of crops in dry seasons; much greater than those manured from stables. The last three years have been so dry, that many who first began to use muscles at that time are getting somewhat discouraged, as they have received but little benefit from it; but the wet weather of last July set its principles in action, and the fields looked better last fall than they have done for four years. I do not think the mud loses its virtue materially while lying dormant in the dry seasons, for fields which have had it applied to parts of them will show it in wet seasons for twenty years afterward. Its durability on flat, moist, what are termed heavy clay lands, I think, is greater than stable manures, while on dry clayey loams I should prefer the latter for its greater retention of moisture in dry seasons.

The action of muscle bed is much greater on lands to which it has not been applied before, than it is in after applications. It will continue to act for many years without a change of dressing, but it requires larger quantities to produce the same results. On some lands near the shore it has been used in such large quantities as to spoil the land, as it is termed—that is, it makes the land fall heavy; it bakes and cracks very much in the summer; is very susceptible to a drouth; muscle bed fails to do any good, and the crops will be light notwithstanding the land is not deficient of the elements necessary to produce the crop.

---

* I do not recollect which of these years was the first in this last series of dry seasons, and I write from memory.

In such cases the land can be restored by dressing with vegetable matter, such as swamp or salt marsh muck composted, or the eel grass and sea weed which drifts to the shore, or barn manures, after which the muscles will act favorably again. I think if a farm was manured alternately from the stables and muscle beds no such trouble would occur, neither will it be likely to occur on farms two or three miles from the shore, as they will not be likely to use it too abundantly.

One farmer near here applied nearly one hundred cords to five acres of land. It was put on three years ago, but has not produced much hay since; whether this is owing to the dry seasons we have had, or from "too much of a good thing" I cannot say, but another year may prove it.

It varies in quality. That is considered the best which contains the most shells. Many think the lime from the shells, and the salt, are the chief fertilizers; but a part of the shells contain fish, and the empty shells denote decomposed fish in the mass, which are valuable fertilizers; but a large proportion of the animal matter must evaporate when it is applied to the surface.

But few if any well-directed experiments have been made in this vicinity to ascertain its comparative value with other manures. We are satisfied to know that it *pays* to get it, and we get it when we can.

There is one field in this town that was heavily dressed with it thirty years ago. It continues to produce a good crop of hay now, and I understand it has had no manure of any kind applied since. Another piece of two acres was dressed very heavily thirty-five years since. So much was put on that it produced but very little for three or four years, after which it bore very heavy crops of grass for several years. It was then turned out to pasture, and has continued to pasture two cows per season ever since. It is the best manure for wheat and barley that we have. In a prize essay on the culture of onions, written for one of the agricultural societies in Massachusetts, the writer stated that he considered muscle bed indispensable to the production of a good crop of onions. He applied four cords per acre, for two or three years, with grain-fed stable manures. I have never known it tried on the onion bed by any persons around here.

I have here written you a plain statement of my observations and experience in *one* of our valuable marine manures, and after summing them up I think you will agree with me that it *is* a privilege to the coast farmers; but the privilege is not used to the extent that it ought to be, or we should not see so many *hungry* looking fields in the vicinity of such valuable deposits.

Respectfully yours,

WM. ROBERTS.

Yarmouth, Jan. 20, 1864.

S. L. Goodale, Esq., Saco, Me., Secretary of the Maine Board of Agriculture.

The regular session being resumed, Dr. Weston, for the Committee on the first topic submitted by the Business Committee at this session, presented the following

REPORT ON THE INFLUENCE OF MANUFACTURES ON AGRICULTURE.

If we pass in review all ancient, mediæval and modern times; if we trace effects to causes to discover the sources of power, we shall find that those countries whose citizens engage in the most diversified pursuits ascend the highest in the scale of prosperity and independence.

Agriculture, Manufactures, and Commerce comprehend all the multiform branches of industry prosecuted among mankind. Their varied interests are one and inseparable, now and forever. "They are not antagonistic, but so entirely intertwined and dependent upon each other, that it is impossible to benefit either without advancing the interests of each, or to injure one without embarrassing all.

Agriculture imparts to manufactures food and raw materials, and to commerce food and freights; manufactures furnish to agriculture clothing, tools, and a home market, and to commerce ships, railways, cars, tools, clothing and business; and commerce, both foreign and domestic, animates and vivifies the production and interchange of commodities for both and for all. Without either, the others languish and die. And when all act harmoniously, side by side, and the *nearer together the better*, then and only then do nations rise to the highest attainable point of independence, wealth and power."

A State exclusively agricultural must send its productions, both cumbersome and light, to a foreign market, and exchange them for fabrics which command a high price, because there is no home competition; besides if the foreign nation has the monopoly of commerce, the transportation would absorb a large share of the profit, so that comparatively little would be realized after defraying the expenses of freight; then cattle, hay and grain would be removed, consequently valuable manure would be lost, the land would gradually be impoverished, and fail to support its inhabitants, and thus would it be ascertained by sad experience that the nation which begins by exporting only raw material must end by exporting or starving its population.

But if the farmer and the artizan are located side by side, if manufactures are encouraged and protected by a wise national policy, then home markets are everywhere provided, then there is a demand for all the various products of the fields, the gardens, the pastures, the orchards; their prices improve, the cost of transportation is diminished, commerce is developed and employed as an agent to go and come at the beck and call of each, real estate is enhanced in value, capital is augmented, both population and wealth increase, and the prosperity of one great interest reacts upon the other in never-ceasing progression.

Our own State is fortunately well adapted for Agriculture, Commerce and Manufactures. Among its agricultural resources are a great variety of soils from sandy loam to stiff clays, some of which are rarely surpassed in fertility by any lands in the temperate zone, and both land and sea can yield inexhaustible supplies of fertilizing materials such as lime, muck and marine manures to renovate impoverished and barren fields. Its surface is usefully diversified by plains, hills, valleys and mountains; and it is abundantly watered by springs, brooks, rivers and lakes, which are equably distributed.

Fat cattle, strong and swift steeds can everywhere be raised. Its rich pastures are adapted to the portly short horts, its hills to the hardier breeds, such as the Devons and Ayrshires, and its islands, hilltops and mountains may be covered with myriads of sheep, so that beef, mutton, milk, butter and cheese may abound to feed all the inhabitants and afford a surplus for exportation.

Our climate is not only favorable to the development of a healthy, muscular, enterprising people, but is of such a nature that they can engage in long protracted labor without that fatigue and enervation which those of more southern climates experience. It is one of the best working climates in the world. Even its extremes of heat and cold are beneficial. The frosts of winter permeate, pulverize and ameliorate our soils. Its snows protect our grasses and grains, give easy access to our forests, and enable us the more easily and successfully to harvest our lumber. The abundant, timely rain "watereth the earth and maketh it bring forth and bud, that it may give seed to the sower and bread to the eater;" and the long unclouded days of summer can bring to perfection and ripen in profusion crops of corn, grains, vegetables and fruits sufficient for a dense population of industrious citizens.

Its facilities for navigation are unrivalled by any other State. It is estimated that its coast line, including the various indentations into coves, harbors, bays and rivers, measures three thousand miles; and the water along the whole Atlantic border is so deep that ships of the largest class can approach at numerous points for refuge and for traffic.

The general direction of its rivers is at right angles to the ocean, and they occur at convenient distances from each other; and when winter imposes an effectual embargo upon the rivers, even then they contribute to the welfare of commerce, and become sources of wealth by yielding an abundant harvest of ice, which may be gathered and stored to furnish freight to a numerous fleet of vessels when the warm, moist breath of spring shall have melted and removed the solid barrier.

For the purposes of internal commerce, railroads have already been completed between important points, and the country is such that they can be multiplied and extended as necessity requires.

Common roads of the most solid and permanent character, in addition to those already in existence, can be constructed in all directions, of the best materials. Hundreds of miles of telegraphs, like so many nerves, stretch across the State, from New Hampshire to New Brunswick, from the sea to Canada, and all these may become most useful auxiliaries in the transaction of business. However great the demand in coming ages for foreign commerce and internal transportation, that want can be supplied by our own citizens everywhere throughout our domains, from centre to circumference, without crowding, without confusion.

Maine has remarkable capabilities for manufactures. It has many a wild, fleet stream which may be caught as it is about to leap down some precipice and harnessed to useful machinery and made entirely subservient to some skilful controlling mind, under whose guidance it may convert the raw material into a valuable textile fabric, or mould it into a thing of beauty or utility. All its rivers abound in rapids and cascades, and when arrested in their course by suitable dams, they furnish an unfailing supply of water for manufacturing purposes, both during the droughts of summer and the congealing cold of winter.

All experience demonstrates that water, when available, supplies the cheapest, most profitable power; but in certain localities which are destitute of it, where villages and cities have grown up whose inhabitants have engaged in industrial pursuits, which have ceased to be remunerative, and desire to turn their labor into new and more lucrative channels, to such steam power offers the required desideratum. It is also indicated in those particular localities where the elements of manufactures are abundant, and where it is desirable to congregate communities of artisans to develop the natural resources of the country, and provide home markets for the neighboring agriculturists. For the nearer the consumers are brought to the producers, the greater the profits realized. A bushel of grain or a ton of hay within a mile of a market, will command the same price as one raised twenty or fifty miles distant, while the cost of transportation is much less; hence the more numerous and nearer the markets, the more agriculture is stimulated and wealth diffused.

The steam engine is a voracious devourer of fuel. It demands new and constant supplies, without which it cannot work, but however greedy, we have the ability to satisfy its wants. Our extensive forests can furnish the material required, or our lumber can be exchanged for the easily accessible coal of other States, the one giving freight to our coasters, the other supplying them with ballast to return.

The most ample materials to be subjected to the cunning transforming hand of the artisan or manufacturer can easily be obtained.

Even cotton, ere long, will be provided without stint, when the war shall have closed, and the blighting mildew of slavery shall have ceased to exert its baneful influence; when a free, enterprising, industrious, christian people shall cultivate with their own hands the fertile fields of the sunny South, then their capacity to produce this useful and necessary material will be developed to the fullest extent, and henceforth more than enough will be raised to tax the ability of all the machinery in the country.

Maine need not be indebted to any other State for wool, flax and leather. It possesses iron of the best quality, only waiting to be wrought to furnish all its tools, its engines, its machines, its various utensils. Its timber is ample for naval and domestic architecture, for furniture and other purposes. Its banks of clay will discount any amount of bricks for buildings. Its quarries of granite, slate and lime, are inexhaustible. The mere mention of our resources suggests their use and value, and it only remains for us to avail ourselves of the means which God has so bountifully placed in our hands.

Notwithstanding our manifest natural advantages, Maine has not kept pace with her sister States. She has prosecuted agriculture and commerce to a very considerable extent, but has comparatively neglected manufactures.

More than twenty years ago, when Congress had imposed such a tariff of duties on merchandise imported from foreign countries as would yield a liberal revenue to government, and would at the same time favor and protect home industry, many capitalists abroad, discerning the excellence of our unappropriated water power, desired to invest their money in available sites, and applied to our Legislature for acts of incorporation; but our farmers then entertained an unwise prejudice against all corporations. They hated monopolies, and were bitterly opposed to granting particular privileges to any class of men, or exempting their property from taxation, until their mills could go into successful operation. Blinded by jealousy, they did not see that this capital would be a most desirable acquisition, that it would build up flourishing villages, create a home demand for farm products, and enhance the value of real estate.

Politicians and demagogues took advantage of this prejudice to advance the interests of themselves and party. They mounted this hobby, and flaunting their banners to the breeze, inscribed with the mottos, "Free Trade and Sailors' Rights," "No Monopolies," they rode into power. Their legislation was consequently illiberal and repelling; and hence they prevented the investment of millions of dollars in the State. Still, in spite of opposition, a few cotton mills were erected in the most favorable localities, enriching their stockholders and contributing to the wealth of the whole neighborhood; and the antipathy to capitalists and corporations has gradually vanished, for the farmers in their vicinity have sagacity enough to comprehend that property has increased in value simply because all their products find a near and good market, and command better prices.

If a different and more far-sighted policy had formerly been adopted, we might now have scores of Sacos and Lewistons, and might have travelled far on the high road to prosperity.

Look at England, a country but little larger than our own State. Being destitute of water power, she is obliged to manufacture by steam, and so she has added engine to engine, until it is estimated that their aggregate power is equal to the united forces of 600,000,000 men, or each man in Great Britain has one hundred willing slaves to do his work who are entirely subservient to their overseers; slaves who never know fatigue, or experience sickness, or suffer from hunger, for they eat only fire and water; and forty thousand laborers delving in the coal mines can supply all their wants. And now see the effects. In consequence of this mighty power, directly and indirectly stimulating agriculture and commerce, she has piled up her vast wealth of $30,000,000,000.

By the invention and introduction of the spinning jenny and power loom, cotton fabrics, instead of being imported from India, at great cost, were made at home; hence the population of the country was no longer stationary; wages rose in every kind of employment, and the demand for agricultural products increased to such an extent that England became an importer instead of an exporter of grain.

Great Britain adopted a highly protective system until her ingenious mechanics had invented labor-saving machinery, and her cotton fabrics could be made cheaper than elsewhere, then she preached free trade to other nations, and would fain persuade them to attend exclusively to agriculture, and allow her to transport their cotton and wool and other raw materials to her own mills to be greatly augmented in value by the process of converting them into calico prints and other cloths, to be returned to them in exchange at her own prices. But there was no free trade in the machinery for spinning cotton, or in any other machinery. The exportation of that was expressly prohibited, and no drawings of it could pass through her custom houses, for her lynx-eyed officials were ever on the alert to prevent, and every possible obstacle was thrown in the way of the emigration of her artisans; yet, Samuel Slater, in 1789, succeeded in eluding their vigilance.

He had qualified himself expressly to remove to the United States by laboring in the cotton mills in various capacities up to general superintendent. He made drawings of the machinery on the tablets of his memory, which he afterwards secretly transferred to paper, and finally he left his native country in a clandestine manner, and came to America to establish here the cotton manufacture by Arkwright's processes.

His practical eye selected as the sphere of his future operations, the Blackstone River, which between Worcester and Pawtucket, in a distance of thirty-five miles, falls about one thousand feet, and affords the amplest water power. He first erected a cotton factory at Pawtucket, and afterwards others at Slatersville. He also engaged in the woolen and iron manufactures, and no seeker of fortune among the golden sands or mines of California was ever more successful in acquiring wealth than this manufacturer on the banks of the Blackstone.

His example was contagious, and now on that river and branches at least fifty villages are engaged in the same profitable business, and thus numerous markets are brought to the very doors of the farmers, so that everything they can produce is in active demand. All the provisions they can supply are required by the busy operatives. All their wool is needed by the hungry mills, all their leather for belting, all their woods for machinery, bobbins, spools and fuel, and even the barren superannuated apple-tree is the only wood used for shuttles. So all the fragments are gathered up, nothing is lost; and the more each class prospers, the more they react upon and benefit each other.

Thus this rapid stream, which formerly ran to waste, has enticed genius and capital to its banks, through whose joint efforts it has been harnessed to useful machinery and made to labor with giant energy and ceaseless industry for the welfare of mankind; and so fast did business here increase, that first a canal and then a railroad was made expressly for its accommodation. To these causes, the city of Providence and all the surrounding country is largely indebted for their noted prosperity.

Look, also, at Connecticut, dotted all over with workshops, where the water power of every stream is occupied and used repeatedly; where steam and every other power is making everything, so that the whole country is inundated with its machinery, wares of all kinds, and an infinite variety of useful articles, and see how agriculture is stimulated to the utmost degree to supply the home demand for farm products.

The manufacturer takes comparatively worthless materials, and after subjecting them to the labor of skilful hands and intelligent brains greatly augments their value; he associates others with him, and liberally invests capital in his business. From cotton he weaves the most useful prints; from wool, the finest broadcloths, carpets, and Gobelin tapestry; from feldspar he moulds the costly china and Sevres porcelain; from the precious metals he makes the most valuable ware; from the iron ore he forms the most potent engines, machines and tools; and from quartz, or the sand we tread under our feet, and potash from the ash-heap, he makes the beautiful transparent glass.

The greater the skill and genius with which he performs his work, the larger the sum he obtains for his merchandise and increases his ability to buy what he needs. Becoming rich and intelligent, he has more wants, both physical and mental. He buys in greater quantity and variety; he buys a better quality of goods and food, and thus becomes a better customer to the agriculturist, for the farmer not only needs customers, but he derives the greatest profit from those that have the most wealth and can pay the highest prices for the best products.

The National Government hereafter must necessarily afford adequate encouragement and protection to home industry, either directly or incidentally, by the imposition of duties on foreign merchandise to raise a revenue sufficiently large to pay the interest of the debt contracted by the present war, and so this debt, instead of crushing us, may, like the keystone of an arch, only serve to compact and unite us more firmly together; and even the war, besides being a rod of affliction and chastisement, may prove in its results a diviner's rod to discover and develop our own resources.

During the past half of the present century, the cotton manufacture has been one of the principal agents in extending the growth and prosperity of New England. It has opened new avenues to wealth, supplied new incentives to energy and activity, encouraged immigration, increased the current value of the lands, timber, mines and water-power, and has given steady employment to commerce. Although but a small portion of the cotton crop of the country has been used in these Northern States, yet ample statistics show that they have received more benefit from it, than the whole crop afforded to the States where it was raised.

In this profit, Maine participated in a less degree than many of her sister States; but instructed by past errors, and by the experience of others, she has lately adopted a different policy. Becoming convinced that *capital* was the great want to set the wheels of busy machinery in motion and provide home markets, her Legislature wisely exempted the mills at Lewiston from taxation, and although they yield no direct revenue to the State, they more than pay indirectly. This is a step forward in the right direction. Feeling the impetus of this new policy, the cotton manufacture increased in Maine, from 1850 to 1860, 152.3 per cent., and the number of spindles 163.3 per cent., exceeding that of any other State during the last decade. And henceforth let capital and artisans and mechanics be enticed among us until we can make nearly everything we need for home consumption, and a surplus for exportation.

There are some special manufactures, the materials for which may be furnished by our own agriculturists, which consequently to them are of greater relative importance. Among these the woolen is second to none. The manufacture of wool is of great antiquity. All its varied processes were once laboriously performed by hand labor, but now the great majority are executed by ingenious machinery, under the superintendence of skilful artisans, producing a greater abundance and better quality of fabrics.

Wool is one of the most valuable gifts ever conferred by a bountiful Providence upon mankind. It can be converted into a great variety of clothing which is indispensable in our climate during the rigorous cold of winter, and which may also be adapted to summer use. Being a non-conductor of heat it prevents the escape of caloric and helps to keep the temperature of the body constantly at ninety-eight degrees at one season, while during the other, from its peculiar characteristics, it absorbs perspiration and obviates the deleterious effects of heat.

The short, stapled fleeced wools, as a general rule, are used in the making of broadcloths, cassimeres, doeskins, felts, &c., and the long fleeced and pulled wools are worked into those fabrics that require neither fulling or felting, such as flannels, muslin de laines, hosiery, carpets, lastings, &c. The mere mention of these goods indicates their diversified use as articles of apparel for the whole person, and for other purposes. They require a great variety of wools, from the fine soft texture of the Merino down through the coarser grades of Southdowns, Leicesters, Cotswolds, to the hardy acclimated natives.

Broadcloths have not been extensively manufactured in this country, chiefly because they could not successfully compete with the foreign commodity, which could command an abundance of the best Saxon, French and Spanish Merino wool, but the improved Spanish Merinos of Vermont are not surpassed in the excellence of their wool by the best in Europe. These have already been introduced into this State, and may be multiplied to any desirable extent, so that enough broadcloth, equal to the best German, may hereafter be made for home consumption and thus retain among us the money now sent abroad.

The general prosecution of woolen and worsted manufactures would powerfully stimulate sheep husbandry. It would cover our thousand hill slopes with valuable improved flocks. The best wool and mutton would be produced, furnishing that clothing and meat most conducive to health, and blessing alike both buyer and seller.

Flax is another material which can be abundantly produced in the State. During the last session of Congress, (1862–3,) an appropriation of $20,000 was made, and three Commissioners were appointed to investigate to what extent flax and hemp could be profitably manufactured and substituted for cotton. Much is hoped and anticipated from their researches.

Science and ingenuity have already coöperated to diminish the labor required to produce linen fabrics from the raw material, and it is not chimerical to expect in this age of progress, that some new chemical processes for releasing the flax from its glutinous envelope, and improved machinery for effectually separating it from the brittle woody substance with which it is united, may soon be discovered, so that linen tissues of every description, from strong cloth to the costly lace can be so cheaply made as to compete successfully with cotton goods.

Then the farmer, being relieved from the laborious and tedious work of rotting, drying, breaking, scutching, hackling, &c., would more generally cultivate flax and leave the subsequent manipulations of the crop to those who provide at convenient points special establishments for the purpose with the necessary fixtures and appliances, and whose capital and skill can be more economically and profitably employed. Thus a ready market would be provided to which the straw in any quantity required could be sent as soon as harvested.

The production of leather has most intimate relation to the interests of the farmer, stock raiser, manufacturer and merchant. It employs abundant capital and numerous agents. It consumes every skin of flocks and herds at home and sends ships to foreign lands for hides, and strips the bark from oaks and hemlocks to tan them. Every member of the human family, unless outside the pale of civilization, needs to be constantly shod with leather. It is essential, also, for gloves, harnesses, book-binding, and other purposes. No other substitute so useful, so valuable, has yet been discovered.

The total value of the leather produced in the United States for 1860 was $63,090,750, of which New York produced twenty millions; Massachusetts, ten millions; Maine, two millions, and all the Southern States but four millions.

Its manufacture into boots and shoes in the country employs a larger number of operatives than any other single branch of industry, not even excepting cotton, all of whom must be fed, and clothed, and housed. Massachusetts has derived a large share of her prosperity from this business, having made boots and shoes in 1860 worth $46,000,000, equal in value to more than a third of all the cotton ever exported in any past year. The largest production of any one town was that of Lynn, amounting to $4,867,399. In Haverhill it was valued at $4,130,500; and one company of proprietors in North Brookfield made, in a single establishment, boots and shoes worth $750,000, and in all five of their establishments, over a million pairs valued at more than $1,300,000.

In 1859, the shipments and sales of Boston dealers amounted to more than 750,000 cases, for which they received $43,120,000. Thriving villages have sprung up, population and capital have increased, the ingenuity of her mechanics has manufactured an article of the highest perfection ever attained. Whatever their cunning Midas fingers has touched, handled, wrought, has turned to gold.

These statistics and facts convey important instruction. Maine may well sit at the feet of the mother State and learn useful lessons. If we profit by her teachings and example, we shall introduce the same lucrative manufacture throughout the length and breadth of the State: then no longer shall our flocks and herds be driven every autumn across the borders and sold abroad, but their skins and meat will find a ready market at home, the one being converted into leather and made into useful fabrics, the other contributing food to those engaged in their manufacture, and thus both shoemaker and stock raiser will be mutually enriched.

The manufactures of iron are of great importance and furnish many useful articles of prime necessity to every individual in the community, We cannot well build houses or warm them, cook food or partake of it without them. Upon iron we are mainly dependent for tools and implements, without which we could not properly till the soil, sow the seed, cultivate the growing crops, and gather the ripened harvests. For utility it is more valuable than gold, and worth more to mankind than all the metals termed precious. Of this useful metal Great Britain furnishes more than one-half of all produced in the world, yet the United States has more in quantity lying dormant and undisturbed, awaiting the application of capital and labor to prepare it for widely diversified purposes. Maine has an abundance to supply the smelting furnaces in many localities where the necessary fuel can be cheaply furnished and the means of transportation provided.

Among the most promising ores is that in Wade plantation, Aroostook County. This iron has remarkable strength and tenacity, and like its counterpart in Woodstock, N. B., is the best for sheathing our iron gunboats, and hence it is of national importance. Great Britain has used plates manufactured from the Woodstock ore in the construction of the Black Prince, having ascertained, by experiment, that while plates made from other iron were shattered by projectiles from an Armstrong gun, these were only slightly indented. If our Government, convinced of its superiority and value for naval architecture, shall engage in its manufacture, and furnish the best means of transportation, it will thus indirectly promote the interests of agriculture in that whole region.

The most important bog iron ore is at Katahdin Iron Works. The metal is easily and cheaply reduced, but it costs from five to six dollars a ton to convey it to Bangor. A railroad in that direction would very materially diminish the expense of transportation, and render its manufacture profitable. It would also make the slate quarries at Brownville and vicinity easily accessible, where may be procured any quantity of roofing slates and slabs, which in quality are equal to the best productions of Wales. And were both mine and quarry wrought to the fultest extent, villages would grow up and afford markets to a surrounding population.

A large amount of iron produced and used in any country is a guage of its progress in agriculture, manufactures, commerce and civilization. It tells of better agricultural implements, of improved husbandry, of an increased demand for food and other supplies for thousands of miners, machinists, and makers of nails, cutlery and hardware. It tells of the construction of railroads, telegraphs, steam engines, locomotives, machines for sewing, spinning, weaving, mowing, reaping, threshing, all the various instruments of science and the arts, of peace and war. It calls into requisition, steamboats, ships, cars, and every kind of transportation, and employs numerous merchants and capitalists.

In the fabrication of these implements, the different kinds of wood are essential, of which the State contains an unlimited supply. And when winter has planked over every stream, and its snows have opened a passable highway to every tree, and our farmers can no longer work their fields, then it is practicable for them to remove even the giants of the forest, and convey them where they may be manufactured, not only into all those structures requiring the joint use of iron, but also into furniture, wooden ware, casks and boxes. And these lumbering operations give employment to many agriculturists and their teams during a leisure season, and require their surplus hay and provisions. And so the capitalists, easily obtaining the necessary iron and wood, have already erected shops for making machines, plows, scythes, axes and shovels, and it is hoped that these are but harbingers of many others which shall dot the whole State and employ numerous operatives.

During the past year, the first glass works ever erected in the State have been established at Portland, and are now in the full tide of successful operation; and it is confidently expected that they will prove a source of profit to the stockholders, and add much to the business prosperity of that city. Maine furnishes the bricks and lime for the necessary buildings, the materials to be manufactured, and the engine to crush the quartz.

The clay is moulded into crucibles which are arranged in the furnace and filled with a fixed alkali, silex and other ingredients which enter into the composition of glass. Heat is applied, and the different articles are fused together. The molten mass is without form and void, but the skilled artisan breathes upon it, and it forthwith crystalizes into things of beauty and utility, and henceforth gives light and cheerfulness to our dwellings, and ministers to our necessities, or he pours it into carefully constructed moulds, and it assumes shape according to his will, and becomes a chosen vessel of usefulness and honor.

The manufacture of straw is also a source of great profit. It involves the expenditure of considerable capital on the part of the principal dealers in the fabric, and when shrewdly and wisely managed, has yielded them great wealth. It enables a comparatively poor country to support a large population. Massachusetts employs 10,000 persons in this branch of industry, who make 6,000,000 hats and bonnets annually.

Were a traveller in that State to pass through Foxboro', Mansfield, and other towns in the vicinity, he would see an active, industrious people, houses manifesting good taste, and everything indicating general thrift and prosperity, nevertheless he would observe that the country was comparatively flat and barren, yet producing a flourishing crop of rye, but on inquiry he would learn that the foundation of all this wealth was straw, that "Foxboro' was built of straw."

The material employed in the manufacture of bonnets is rye straw, and the imported Florence braid made of a species of grass. Formerly the material was mostly foreign, now the domestic is principally used. This rye straw is first whitened or bleached with the fumes of burning sulphur; it is then drawn over a comb-like instrument having sharp teeth which penetrate the stalk and divide it into strips. In the subsequent processes are employed men, women and children, who receive a liberal remuneration for their labor. The more ingenious make the necessary ornaments from it. The children braid, the women sew, and the men press the bonnets on blocks, principally in factories constructed for the purpose. Sewers are paid according to the amount of braid, and an experienced person can sew enough to make from three to six bonnets, earning, on an average, fifty cents a day.

The style of bonnets changes three or four times in a season, requiring alteration in blocks to correspond to change in fashion.

They are chiefly made for the New York market, and when sent at the right time, or as soon as possible after the fashion is received from Europe, a great profit is realized.

A flat country is best adapted for the straw manufacture, a hilly, on account of its water power, for other manufactures; hence the one is the natural complement of the other.

Maine has an abundance of sandy soils, abounding in silex, well adapted for the cultivation of rye, and ought, at least, to make bonnets, hats and straw carpets enough for home consumption, then her sandy plains shall wave with golden grain, and many now idle fingers shall engage in a healthy, lucrative employment.

The cultivation and manufacture of the osier willow would doubtless be profitable to the agriculturist and beneficial to the State. The value of this willow in its crude and manufactured state, annually imported into the country, amounts to $5,000,000. The price of the canes is from $100 to $130 a ton in weight. The cost of raising them is found to be from $30 to $50 a ton, and an acre will yield from one to four tons.

The best situation for an osier plantation is a low, level tract of land, which can be drained and also overflowed during a drought, though the flowing is not absolutely essential, with soil deep and moist, but which can be thoroughly worked with plough or spade.

Maine has many rich meadows and valleys adapted to its cultivation, where it is believed it can be produced as cheaply, and of as good quality, as in any other country, and to any extent the market may demand.

The osier is propagated by cuttings from one to three feet in length. These can readily be procured from the Patent Office at Washington, from thrifty plantations in Vermont, and from nurseries in this State. They are set diagonally two-thirds of their length in the soil, one foot apart and in rows three feet apart. In the season of growth they are judiciously thinned by breaking out superfluous buds or shoots; the ground is ploughed between the rows twice a year, or if this is impracticable, the grass is extirpated by hoe and spade, or cut with a sickle.

The shoots are cut every year within an inch of the stump, and tied into large bundles, the lower ends of which are thrust into water until they are peeled. The bark is removed by drawing them through an iron-edged instrument called a brake, or by means of a labor-saving machine invented by Mr. George H. Colby of

Vermont, which does the work cheaply and effectually. They are then exposed to the air and sun until they are properly dried, and afterward interwoven into baskets of various form and size, carriages for children, coverings for demijohns, &c.

The manufacture of broom corn into brooms is an important branch of business in many parts of the country, from which very considerable profits are derived. The demand for them is very general and constant. Every tidy, industrious housewife needs several of these useful instruments every year.

To Dr. Franklin, that distinguished advocate of domestic economy, is the United States indebted for the introduction of broom corn as an agricultural product. It can be raised in almost any soil where Indian corn can be produced, though rich alluvial lands are best adapted for it. Its terminating brush furnishes the material from which brooms of the best character are made ; its seeds will often more than pay the expense of cultivation and preparing the crop for market, as they are excellent for fattening sheep, and for feeding cattle when ground with grain ; its broad leaves afford forage, and its long stalks contribute to the valuo of the compost heap.

An acre, on an average, will produce five hundred pounds, worth $30, (a ton of the best quality will now sell for about $200,) while the cost of cultivating, harvesting and cleaning of seed by horse-power scraping machines, amounts to only $10.75.

The entire cost of a broom is but ten cents, including the price of brush, handle, wire, twine, labor and use of requisite machinery. It has been ascertained that the capital invested by the Shakers in the business has yielded a net profit of from five to twenty-five per cent., and there is no good reason why any section or class should have a monopoly. Competition is open to all who may incline to engage in this employment and participate in the advantages. Were this manufacture introduced into the State, our farmers would be stimulated to cultivate this crop, so beautiful in appearance, and enough brooms might easily be made for home use and a surplus for our neighbors in the British Provinces, where it cannot be profitably raised.

Many other small manufactures might be appropriately mentioned, which are nevertheless great in their aggregate results, but the object of this paper is now accomplished, if it shall simply direct attention to a subject second to none in importance.

That the more general prosecution of manufactures in the State would powerfully stimulate and benefit agriculture and kindred interests, would seem to be a self-evident proposition, requiring neither argument nor demonstration, yet the plainest truths are often latent. They are like seeds which long lie dormant in the earth until favoring circumstances cause them to germinate and grow and bear fruit; so these truths may need line upon line, and precept upon precept for their elucidation, that they may be fully comprehended and believed, and that faith may manifest itself in works.

All the avenues to wealth and independence are wide open, the goal is in full view, and it depends upon the present generation to determine whether Maine shall enter zealously upon the race of progress; whether manufactures, agriculture and commerce shall harmoniously advance with even strides, each keeping step to the music of the other, and all powerfully contributing to a common prosperity.

Let educated intelligence, discriminating capital, and skilful labor, vie with each other to discover and develop all our resources, all the capabilities of steam, caloric, electricity and all other elemental forces with their applications to the useful arts. Let a wise governmental policy encourage them by every feasible method, and give them all full play. Then shall the State, throughout its whole area, teem with industrious millions of enterprising inhabitants, and become a seat of power and influence commensurate with its natural advantages and resources.

We respectfully submit the following resolution for adoption by the Board.

J. C. Weston, *for the Committee.*

STATE OF MAINE.

Board of Agriculture, Jan. 22, 1864.

Whereas, the prosperity of agriculture depends greatly upon the extent of the home demand for farm products; and because such demand is smaller here than it is in other States, where the number of consumers is proportionately greater than it is in Maine; and because the value of land in Maine is consequently less than the same quality commands where manufactures prevail to a greater extent; therefore,

Resolved, That we recommend to the Legislature the adoption of such measures as in their judgment may most effectually encourage the prosecution of all branches of industry, and especially the establishment of manufactures of every sort for which we have sufficient water power and other natural advantages.

This report was discussed not only in formal session, but at one or two informal meetings, at which the joint Legislative Committees on Manufactures and on Agriculture, together with other gentlemen, were present and participated.

Hon. Mr. Cram of the Senate presided, and remarked that the committee of which he was chairman had now under consideration a bill to permit towns to exempt manufacturing corporations from taxation for a limited term of years—and would like an expression of opinion from those present in regard to the expediency of such an enactment. He was himself in favor of a liberal policy—one which would invite the investment of foreign capital. He believed that all interests were linked together, and that what aided one would benefit all, either directly or indirectly.

Hon. Charles Holden of the Council, in response to an invitation from the Chair, spoke as follows:

I came in, Mr. Chairman, to listen to the essay of my friend, Dr. Weston, and I am happy to say, what I have no doubt all of this audience feel, each for himself, that I have been highly interested and instructed. Though I was detained in another part of the capitol, for some time after the exercise commenced, I have heard sufficient of it to assure me that it contained valuable matter, which the people of Maine ought to well understand, and that it is full of that practical wisdom, which is of immense interest to everybody. I have not the conceit to presume, that on this topic, so well illustrated as it has been, I can add much, if anything. It is essential that some one should begin the discussion, and I am very happy, if it be necessary, to break the ground, with a few words of commendation, if thereby our interchange of opinions may be facilitated. It is good to talk these matters over here, not only for ourselves, but for the State at large. Thanks to the facilities of the printing press, what may be said here by this little band, will find its way into the hands of thousands of the people of the State, to be by them conned over and made available. Hence, I hope, that the men of well-trained minds and practical information, whom I see all about me, will make this a free and general discussion, that what they are so well posted on, may, by means of the faithful reporters present, find its way to every nook and corner of the State, and thus do a most blessed work.

Let every one present, so far as the time will permit, give his assent or dissent to the doctrines of the able Essay just read, and his reasons therefor, and thus these points laid down, apparently so essential to our material growth as a people, will be sustained by the testimony of many witnesses, or shown to be fallacious, and of consequence not proper to be relied on.

One or two subjects commended themselves to me particularly as the reading of the Essay progressed. It was a great thought, that you may graduate the use of all things employed in the arts by the use of *Iron*. There have been the dark ages,—the golden age,—the age of literature and science,—and there has been the iron age. As an element of force and service, iron has no superior. Other things being equal, the iron age may be accounted a grand and noble one. The speculative and trading minds of many of our people are watching, from day to day, with feverish anxiety, the fluctuations in the price of gold, and its concomitants—but a far more important observation is that, which watches what progress is making in the various new modes of use, and new inventions, into which the imperial metal, *Iron*, is being transformed. The operations in the former are ephemeral, and the stock market, and its wonderful capriciousness, will cease to hold in wonder its worshippers, when the present emergency ceases. But the march onward to perfection, of the latter glorious metal, will denote the progress of that nation, which turns and moulds it to greatest amount and variety of utility. Let the lovers of iron not lose their devotion by the brilliancy of the gold question—but in the truest sense make this to be celebrated in history as the "Iron age."

Another suggession in the Essay won my attention more particularly. Dr. W. spoke of the Osier willow, and of the propriety of its cultivation in this State. I was not aware till now, that it was grown in Vermont. I have no doubt it was carried thither from Hartford, (Conn.) On two visits to that city, in my public capacity, within the last two years, among the many exhibitions of industry and art in that lovely place, I was highly interested in examining the Osier plantation there, which was introduced from Germany by the late Col. J. C. Colt. Among the many enterprising and far-reaching plans put in operation by this wonderful man, for the enriching and enlarging the city of Hartford,—and which has done so much for that beautiful spot,—he conceived that the growth of this twig would be easily effected in that soil,—that it would be a new facility for employment and trade, and would help to enrich himself. To conceive of an enterprising measure and to do it, with him, were coincident, and the Osier was brought along, set out, and the workman from the fatherland came with it, to transform the delicate shoots into a thousand shapes of beauty and utility. Should you visit Hartford, Mr. Chairman or gentleman, it is quite unnecessary, I have no doubt, for me to say, do not fail to visit the beautiful workshops where this material is twisted into so many elegant and substantial forms; and also observe the modest and unique residences of these people—for they brought their customs and home habits with them, and have not yet shaken them off for those of America. They live in a quarter of the city by themselves, and their peculiar structures, and that part of the place, is by no means the least attractive to the stranger. I would that the State of Maine were favored with many such indefatigable and keen-sighted men as the late John C. Colt.

Seizing upon two or three points like these, which particularly won my attention, I leave others for the elaboration of those who may follow me. All through this Essay are valuable suggestions and facts affording ample food for thought. They have interested me very much. I was glad to hear the point made so resolutely against the doctrine—now, I am thankful, very much weakened from that of old times—that inducements should not be offered by our State, to bring in capital from other States, to help improve and make profitable our great natural wealth, now lying rough and unwrought.

The old democratic party, whose prestige is fast fading away, suffered itself, when it controlled the public interests of this State, to embrace this fallacy. A close, narrow policy, which so embargoed our splendid privileges of field, forest and flood, that the capital which would gladly have made them sing with the resounding echoes of cheerful thousands bringing them into life, beauty and use, found other avenues for their wealth, enriched other lands, and made *them* sing, while ours lingered for years in pristine solitude. This policy was one of the avenues through which this grand old party—to which I was in former days proud of my allegiance—lost it arterial blood. Tax foreign capital heavily, was the urgent doctrine of that dominant party—and it was done; but as the fiat fell upon the capitalist who was knocking at the door of the State for admission—it fell with more ominous echo upon the party that enforced it. That fiat has been lifted. The capitalist has entered and been gladly received—but the party which laid the ban, in its power and exclusiveness, has become feeble and harmless.

The time will come, when, from this enlarged policy towards strangers who would enrich our land while aiding themselves, the State of Maine shall indeed blossom in its yet untrodden fields, with a perpetual splendor. And it shall be through the doings of this Board, if its members be true to their duties, that many of these advantages, growing out of this more enlarged and healthy state of things, shall be effected.

Mr. Holden continued his remarks still further, and spoke of the unwise policy also heretofore taken by the State in excluding manufactures by imposing heavy taxation; and notwithstanding the fact that the people of the State will be heavily taxed hereafter on account of the sore trial that had been for wise purposes put upon them, yet the subject of the proposed bill commended itself so thoroughly, that he thought the State owed it to herself to do something to encourage the starting of manufactures, partly for the benefit that would result therefrom to the people of the State, and partly to make amends for its unjust policy heretofore.

He closed with an elegant description of the future of Maine, when, through the liberality of the State, there should be opened new avenues for the strength, sinew, and power of our people, many of whom, young and vigorous, will be returning, ere long, from a necessary but bloody war, successfully, gloriously closed for the whole world of humanity; and who will then turn with new vigor and zest to the arts of peace—building up and extending all over Maine, pursuits that will add untold wealth and strength and grandeur to our beloved State.

Mr. Goodale said he could not expect to add anything to the force of the views presented in the report, but would make a few remarks. The prosperity of agriculture depended in a great measure upon the number of *consumers*. Many have supposed that it is simply the commerce and manufactures of England that have made her so powerful a nation, and that in these centered her greatest interests, but it is not so. Her agriculture is greater than either, or both together. McQueen states the extraordinary fact that the *animal manure* (throwing out of account the immense amount of artificial fertilizers used) annually applied to the crops in England, *surpasses in value the whole amount of its foreign commerce*; and Daniel Webster tells us there is no doubt that it greatly exceeds it.* But all this does not suffice to meet her wants. She has to go to the ends of the earth for supplies of food, that cannot be grown at home, for her immense population. Why is this? Because manufactures are fostered, and because, being fostered, agriculture and manufactures go on hand in hand. Her food is all consumed at home. No large portion of its value is absorbed and lost to the producer by transportation.

We may have it so here, if we will. Our water power, navigable streams, raw material and other natural facilities exceed those of any other New England State; but they are not improved as they should be, nor as they might have been. There was formerly—and it was very disastrous in its effects—a strong prejudice against the employment of foreign capital. It was thought that if rich men came among us to get richer by establishing manufactures, that, somehow, it must be at our expense. We are just beginning to learn that every dollar so invested is a help to every one in the community. The money so invested creates a demand for labor, and it pays for that labor. It creates a demand for all the products of the farmer, and pays better prices for them than the farmer can realize from their sale in a distant market. It enhances the value of real estate all about it. It helps to pay our taxes, and bears its share of all public burdens; and while we have these advantages in prospect, may it not be well to exempt capital so engaged from taxation for a brief term of years, in order to secure them all before long? He thought so, and thought it wholly safe and democratic in the true sense of the term to let the people of each town decide for themselves. He well recollected, as a boy, the current gossip in the town where he resides, regarding the proposed establishment of cotton manufactures, thirty-five years ago or more. The Boston capitalists who bought Factory island and its water power were stigmatized as "aristocrats," "cotton lords," &c., their advent was not welcomed, little aid or sympathy did they get from the town's people. But now, we understand the working of it better, for the price of land and its products has advanced pretty steadily ever since; while an occasional check to manufacture has repeatedly shown the difference between activity and stagnation. Nobody now wishes them away, and he ventured to say the same is true about Lewiston. The matter is now better understood throughout the State.

---

* Works of Daniel Webster, Vol. 1, page 448.

Again, we have abundance of raw material of numerous kinds. Take iron for one example. We have its ore in abundance and of a quality not surpassed if it is equalled in the world. Plates from the iron made at Woodstock, N. B., were proved at the trials at Shoeburyness, Eng., to be impenetrable to the heaviest shot, which shattered all other sorts tested. The pirate Alabama is plated with that iron, made within ten miles of our line. We have inexhaustible quantities of the same ore within our lines, but not a ton of it has ever been smelted.

Then for water power, we have hundreds of places in Maine where it can be bought for a quarter the cost of a steam engine of the same capactity ; and while the former will run forever at no charge, the latter must be fed continually. This improvement of our natural facilities and resources is the surest and readiest way to enable us to bear prospective burdens and put us on the high road to prosperity.

William D. Dana of Perry spoke of the influence upon agriculture caused by the manufacture of iron in Washington County, and said that land which before was worth but $4 per acre is now worth $40. Wood in the Pembroke market has risen from $2.00 to $3.50 per cord, and other farm products in proportion. By the encouragement of manufactures a market was made at home for all farm products, which obviated the necessity of paying transportation to a remote market. He spoke of the fact that young men and women had been obliged, heretofore, to leave our State to obtain employment in factories and shops of Massachusetts, and hoped the remark that "Maine was a good State to emigrate from" would never be said of us in the future.

Mr. Waterman of Robbinston said the farmers in his section found it difficult to raise enough now to supply the demand. Potatoes in the spring were usually worth $1.00 per bushel, and butter 30 cents per pound. The price of land and the price of house-rent had also advanced in a tenfold proportion in as many years.

Mr. Anderson, President of the Board, spoke of the intimacy of the relation between agriculture and manufactures, and expressed his opinion in favor of such a law as had been proposed.

Mr. Dingley of Auburn referred to the growth of Lewiston within the past fifteen years, all of which was caused by the manufactories in the place, and of the advantage it gave the farmers; yet strange to say, the farmers at first thought the building of mills would be of no benefit to them. What was the result? The town is now four times as large as it was then, and farmers, instead of going to Bath and Portland, a distance of twenty-five or thirty miles, now have a ready market and high prices at their own doors. He believed the former policy of the State in excluding manufactures to be a bad one.

Mr. Woodman of Portland made some remarks in which he contrasted the trade of that city now with what it was twenty-seven years ago, and the influence of manufactures in building it up, increasing its business, and adding to the value of real estate. It now has its manufactures of glass, iron, sugar, and numberless other branches of productive industry. The farmer, trader and manufacturer have an interest in common. One business firm in Portland now performs annually as large an amount of business as was transacted by all who were engaged in the same branch of business in 1827.

Mr. Kelley of Newburg said he had formerly been a resident of Massachusetts, and had noticed the change that had been wrought upon the Merrimac river by the establishment of manufactures, and the wealth that had accumulated there by their agency. He spoke of the advantages of Maine for the purpose of manufacturing, and regarded them as superior to most of the New England States. We have a healthful climate, and we produce the men capable of making the best use of the capital employed in manufacturing operations. Capital is useless without the hand of man to develope and give life to the work which it constructs. Capitalists, twenty years ago, had been discouraged from coming into Maine on account of the wrong policy of a political party then in power, and had it not been for that, he believed Maine would at this day have stood ahead of her sister States in all the industrial pursuits of life. But those days are past, and now is the time for us to employ our long neglected resources and capabilities, and the State should extend the utmost liberality and encouragement to every branch of manufactures.

Several other gentlemen spoke on the subject, all agreeing substantially with the views above given.

The report and resolution were subsequently adopted.

Mr. Goodale, Chairman of the Committee on the proposed Agricultural College, submitted the following Report:

The Committee to whom was given the question "What action will the Board recommend in respect to the proposed Agricultural College?" report: That the more thought has been given to the subject, the more hesitation is felt in expressing a decided opinion regarding the action which would, at the present time, best subserve the interests of the people of the State. The magnitude of the interests involved, reaching as they do into all the future, affecting the development of our untold natural resources and defying computation; the novelty of the subject, the limited experience of similar institutions in this country, together with our comparative ignorance of their working and results; the probable inapplicability to the wants and genius of our people of the methods of other countries; the doubt which exists in the minds of some regarding the extent to which its want is actually felt at the present time among the industrial classes, for whose benefit it is intended, and consequently regarding the probable number of pupils who would, at an early day, avail themselves of its advantages; the uncertainty which attaches to the money value of the grant made by Congress for its endowment, its probable insufficiency *suitably to endow* such an institution as is felt to be needed and to be required by the act; the objections to having it incorporated with any of the existing literary colleges; the necessity, arising from the burdens of the war, of incurring no expenses beyond those palpably needed to meet the wants of the State—all these, and other considerations which might be named, contribute to the hesitation above alluded to.

With only such dubious data with which to arrive at conclusions, your Committee suggest whether it would not be wise to endeavor to obtain an extension of the time during which the College may be provided and set in operation. By the terms of the act five years are allowed for this purpose—dating probably from its approval by the President, (July, 1862.) In all probability such an extension might be obtained, and especially if several of the States should unite in the request, as it is believed they would gladly do.

In view of the disturbed condition of the country, so different from that which prevailed when the bill was under consideration in Congress, the request seems a very reasonable one. The obtaining of it would in nowise hinder the establishment of the College at the earliest practicable period after satisfactory conclusions were reached; while it might lessen any liability to the adoption of ill-judged or unfortunate measures.

Your Committee also suggest the propriety of recommending to the Legislature the appointment of a commission whose duty it should be to investigate the subject in all its bearings as thoroughly as possible, to inquire into the methods, condition and prospects of similar institutions elsewhere, and to report thereon to a subsequent Legislature.

With a view to placing these suggestions in a form for action, the following resolutions are submitted:

Resolved, That the Board of Agriculture recommend to the Legislature that it request of Congress an extension of the term during which the Agricultural and Industrial College may be "provided" by the State.

Resolved, That we recommend also the appointment of a commission whose duty it shall be to investigate all points connected with the establishment of such a College, and to report thereon to a subsequent Legislature.

The report gave rise to some discussion the main point in which was, whether the expression in favor of an independent institution was as strong and decided as it should be.

Mr. Anderson said if the Board is of opinion that it is better to have the institution established upon its own basis, let that opinion be expressed; if it has a contrary opinion, let that be as expressly stated—but let there be no obscurity in the language.

If this institution is established upon its own basis, it may not go along so smoothly for the first few years as if it were connected with some already established literary institution. The governing principle of our action should be, what will be best for a series of years—and we all know that it will commend itself better to the farmers and mechanics of Maine to have its establishment an independent thing. The professors, tutors, pupils and all, had better live for a few years in a log house, if it can have a good farm, good farm buildings, and have the branches well taught. This is the best way to begin. If the State can give $20,000 to such an institution of learning as we already have several of, he believed it could give $100,000 to an institution that would be of such vital moment to the inhabitants of this State from one end to the other, as this will be. He alluded to the difficulties arising from connecting the proposed Agricultural College with some literary institution, among which were the social caste it would create among the students, difference in the objects of the course of study, &c.

Mr. Goodale said the object of the Committee in making the report was not to go over ground already fully covered before. The Board was already fully committed in favor of having it upon an independent basis, by its action last year. The present report threw out the idea that *probably* the fund was insufficient to endow such an institution as we should want at the recent price of the public lands. But if we should wait a few years they will undoubtedly increase in value with the increasing influx of foreign emigrants to our country.

It also enumerates the causes of the embarrassment of the Committee in coming to a decisive opinion upon many points. These are expressly stated in the first half of the report. What is the reason why we do not set down and carve out a detailed plan at once? Simply because there are so many objections to encounter, and these objections are expressly stated. If the phraseology of the report was not distinct enough, it could easily be amended.

The report was then amended by adding the following resolutions:

Resolved, That the Board fully assents to and endorses the sentiments expressed in the resolves upon this subject which were adopted at their session of last year.

Resolved, That in the opinion of this Board it is desirable that the Agricultural and Industrial College should be put in operation at the earliest period practicable.

And thus amended the report was adopted.

Report on Third Topic—to wit: "By what methods may the usefulness of Agricultural Societies be increased?"

The condition of our Agricultural Societies, and the general policy manifest in their operations, were examined at some length during the last session, and the limited powers attaching to the Board were exercised in moderation, to lead the several societies to that course of practice deemed consistent with the design of the act conferring State aid on them.

To what extent the recommendations then made by the Board, may ultimately affect them towards the realization of greatest good, we can hardly estimate from the returns of one year's operations.

The records of the Board show that we have been constantly mindful of the fact, lamentable as it is, of the exceedingly moderate accumulation of practical data that is annually expected from experimental operations in agriculture and kindred pursuits,—data on which all progress essentially depends. That something more is wanted in that direction to give vitality, is self-evident.

The efficiency and success of Agricultural Societies are based on the public spirit of the men who compose them. Their present system of operations is the outgrowth of their experience,—in some cases now extending through an existence of many years.

The policy of the Board, limiting its interference to simple suggestions, we trust will not be reversed without due reflection, and for the most palpable and cogent reasons. Too much stress cannot be laid on the importance of a compliance with existing regulations, where written statements are made the condition on which premiums are to be awarded.

Your committee submit for consideration, a plan that if adopted by the societies in their regulations, may go very far in removing present remissness,—if regulations may ever be expected to control or affect human actions or propensities in matters of this sort.

STATE OF MAINE,
Board of Agriculture, Feb. 1, 1864.

Resolved, That this Board recommend to the several Agricultural Societies, receiving the bounty of the State, that they so amend their regulations as to require all competitors for premiums on crops, dairy products, or other objects for which existing laws require a written statement, including such cases as involve an account current for the season *as a necessity* to the completeness and reliability of such statement when made, to enter their intentions to so compete, in the months of April or May; and that the Secretaries of the Societies be requested to return a list of such entries to the Secretary of the Board, at the close of the month of May in each year.

And to the end, that the habit of awarding premiums on accidental crops, products and results, should at once be superceded by a better and more honorable practice, we recommend that the premiums be so reduced in number that the means at command will allow them to be of such magnitude as will secure an adequate compensation for the time and labor consumed in the experiment.

C. CHAMBERLAIN, *for the Committee.*

Mr. Rogers did not regard the plan proposed in the report, of increasing the usefulness of societies, as one that could be carried out so as to add materially to the present operations of the societies. He regarded the statements made by exhibitors of articles at our shows as of little account, and questioned the expediency of requiring them.

Mr. Jaquith said that crops were frequently entered for premiums when the statements in regard to their expense was not inserted; if it was, the statements were often incorrect. The amounts of crops harvested were often over-estimated.

Mr. Lee did not wish to oppose the plan suggested, but only to question the practical results of the thing. The statements of premium crops, as published in the Secretary's reports, were of but little account, or real use. Was willing to favor any plan that would bring a different result.

Mr. Goodale. The statements of premium crops for the last two years, have not been published, not because they were not good and useful, but because they would occupy too much space, and swell the annual volumes beyond usual size.

Mr. Chamberlain regarded it to be competent for the Board to instruct societies, through its Secretary, how and for what articles or crops premiums shall be awarded. If it had stepped out of its sphere, it was in recommending the entries of premiums to be made in the spring.

Mr. Rogers thought agricultural societies knew better what was the best way to conduct their affairs, and that the Board should not instruct them in so doing. What was the best course of procedure in one section, would not do for another.

The report was accepted, and left to the disposal of the Secretary.

Mr. Rogers, for Committee on Fourth Topic, submitted the following report:

The Committee to whom was referred the question, "What have been the most profitable branches of husbandry the past year?" have had the subject under consideration, and report, that among the numerous branches of husbandry that have been prosecuted, and the diversified circumstances under which they are prosecuted, that it is difficult, if not utterly impossible, to determine precisely which are the most profitable. That branch of husbandry, or that crop, that would prove remunerative in one locality, might prove very unprofitable to another differently located.

We have, however, no hesitation in saying, that the hay crop of our State is by far the most valuable and important crop that we produce, and generally all our farm operations, particularly in the older parts of the State, should be conducted with a view to increase the fertility of our grass lands, and augment the hay crop. We believe that the thrift of those who attend to farming exclusively, and who pursue a mixed husbandry, as do most of the farmers of this State, may be very correctly estimated by the amount of hay they cut.

From the meagre statistics returned the past year, embracing less than half the towns, we learn that there was harvested in those towns in 1862, 370,238 tons of upland hay, which, at $10 per ton, a low estimate of the average price of hay at the barns that year, would amount to $3,702,380. The amount of interval and other low land hay, was 80,484 tons, which, at $5 per ton, amounts to $402,420, making the aggregate amount of $4,104,800 worth of hay returned. Now multiply this amount by two, for you will bear in mind that returns have been received from less than half the towns, and we have $8,209,600, as the value of the hay crop of that season. Admitting that there was the same amount of hay cut the past year, and fixing the average price of upland hay at $15, and interval and other low land hay at $7½, which we think is below the average market value, and we have $12,215,790, as the value of the hay crop of this State the past season, an amount three times the value of all the corn, wheat, rye, barley and oats, that are produced in the State. It will be seen that the raising of grass is not only among the most profitable, but is the most important branch of husbandry in which our farmers engage, and should receive their first attention.

In order to secure the highest prosperity of the farmer, it is not only necessary that he should secure an abundant crop of hay, (in so doing he has made a beginning in the right direction,) but he should also dispose of it to the best possible advantage. In treating upon the topic under consideration, it is proper that we endeavor to ascertain what method of disposing of this crop has yielded the best return the past year.

When hay brings, as it now does upon our seaboard and along the line of our railroads, from eighteen to twenty-two dollars per ton, the inducement to sell is great. We believe that ordinarily, aside from the value of excrement, hay does not yield a return of eight dollars per ton in rearing stock for the market. Of course there should be kept sufficient stock suitably to conduct the operations of the farm, and to supply the wants of the family. Beyond the keeping of the necessary stock, which may usually be done to a great extent with the poorer qualities of hay and other forage not suitable for market, with the addition of roots or other provender, we are forced to the conclusion, that more profit has been derived by farmers in many parts of the State, by selling their hay than by feeding—but these hay-selling farmers should make use of every available means to sustain the fertility of their fields or they will find not only their farms but their purses progressing in the wrong direction, for mother earth, bounteous though she is, ought not to be expected to discount liberally, long after she ceases to receive deposits.

Sheep husbandry, to those favorably located for prosecuting it the past year, has been one of the leading, and perhaps we may venture to say, the most profitable branch of husbandry in which any considerable portion of our farming community have been engaged. By referring to the report of the Commissioner of Agriculture, it will be seen that in 1860, woolen fabrics were imported to the amount of $37,763,745, an excess of twenty-one per cent. above the amount of imports for 1850. Besides this, large quantities of foreign wool are imported and manufactured in this country, to supply our wants.

It is estimated that the people of the United States use annually about four and a half pounds of wool to each individual inhabitant, and this amount is still increasing, while cotton remains at any thing like its present prices. The increase of the wool crop has not kept pace with the increase of our population, while woolen fabrics are being used to a much greater extent than at any previous time in the history of our country. In consequence of the immense national debt with which our Government will be burdened by reason of the war, it is reasonable to expect that the duties on foreign importations will be high for many years.

In view of these and many other reasons that might be named, your Committee are led to believe that sheep husbandry must continue to be a profitable branch of business for some years, at least. Yet we would be far from recommending that all should bend their energies in that direction.

Orcharding, in those localities where the soil and convenience for marketing are favorable, has yielded a rich return for the care and expense bestowed upon it, and under other circumstances it would not be advisable to attempt to raise more than enough for home consumption—this all farmers should endeavor to do.

We might allude to many other branches of husbandry that have been prosecuted successfully under certain circumstances, but will forbear.

In closing we would exhort our brother farmers to study well their calling, so as to turn to the best possible account the limited amount of manual labor left them with which to prosecute their farm operations, relying upon a bountiful Providence to bless their endeavors.

Mr. Dill and some others dissented from the opinion that it was more profitable to sell hay than to feed it to farm stock. After considerable discussion regarding the views presented in the report, it was accepted and left to the disposal of the Secretary.

Mr. Anderson stated that the only member of the Committee on the Fifth Topic who was practically familiar with the subject, had been obliged to leave on account of sickness, and as the others of the Committee had no experience in the matter, and but few facts or data had been obtained—which were that most meadow hay was about two-thirds the value of English hay for neat stock, and that in cold weather it did not furnish a sufficient amount of heat for the animal system—he asked that the Committee be excused from farther service at this time; which request was granted.

Mr. Anderson then submitted the following report on the Sixth Topic:

The Committee to which was referred the subject of the Geological Survey, having duly considered the matter referred to, beg leave to report in favor of renewing and continuing the survey.

Your Committee—(taking the words of a report to the Legislature made in February last)—believe that "the objects of the survey are to ascertain and bring to light, and thus to put in the way of development, *all the natural resources of the State.*" And this, again quoting from the same report, is in fact "taking an inventory of the goods and chattels which we possess, or rather like taking an account of stock of the raw material with which Nature has endowed our domain, and stating the place of its deposit and the probable amount which can be relied on for future use. That such knowledge is not only useful, but necessary to the proper conception of what our domain is, and what can be done in and of ourselves, and, consequently, what our prospective wealth and power may become, is self-evident. Every prudent man deems it necessary to do this in regard to his own private property. The Executive and the Legislature stand in the same capacity to the public domain as an individual proprietor does to his own possessions; and, by parity of reasoning, should take the same pains to ascertain what our resources are. That community is the wealthiest and the strongest which possesses the most of the natural resources of industrial material; *provided*, that while possessing them, they know of their existence, their nature, location and the facilities for bringing them into use, and thus for converting the raw material into actual wealth and power."

Although there may have been sufficient reasons for discontinuing the survey, and although those same reasons may still continue in full force, yet your Committee conceive it to be their duty to consider only what the advantages to the State might and probably would be from a more intimate knowledge of its own resources, which must be obtained from the complete examination which has already been so thoroughly and fairly commenced.

By the fifth section of the act creating this Board, it is our *duty* to "investigate all such subjects relating to agriculture, horticulture and the arts connected therewith," in this State, as we may think proper.

Your Committee believe that the Board has not the right to and ought not to shirk any duty from mere politic motives, while it should carefully avoid infringing upon the province of legislators. Your Committee therefore submit the following resolution:

Resolved, That the Board of Agriculture recommends the resumption and continuance of the geological survey of the State.

JOHN F. ANDERSON, *for the Committee.*

The report was accepted, and the resolve adopted.

Mr. Goodale presented the following resolve relative to immigration, which was unanimously adopted:

WHEREAS, The great want of the State at the present time is labor, and because agriculture being the largest interest in the State suffers more than any other from the lack thereof, therefore

Resolved, That the Board of Agriculture recommend to the Legislature the adoption of such measures for the encouragement of immigration from Europe, and especially from its northern portions, as in their wisdom may be deemed best adapted to accomplish the desired end.

This resolve formed the subject of discussion both at the regular sessions of the Board and at several conferences with the Legislative Committee on Agriculture.

It was remarked that every farmer knows and sensibly feels the difficulty of obtaining help to perform the necessary labor on their farms. This is occasioned by the call of government to fill up our immense armies which are doing battle for the preservation of our government, our institutions, and all that we hold dear.

Taking away from home between thirty and forty thousand of our young and enterprising men into the army, ten thousand or more into the navy, eight to ten thousand more into other duties connected with the service, necessarily reduces our productive and laboring classes to a pretty low figure, and it is no wonder that the farmers who have always had either boys of their own or hired men to assist them in their farm work, should feel the loss of them, and find themselves puzzled to know how they shall carry on their usual business without them.

There is only one way to overcome this evil, and that is to invite into our community the surplus population from those countries or sections of country from whence they can be spared.

It appears by the reports in the papers of the day that there is already a greatly increased emigration from Europe to the United States. Our State, however, is remote from the usual channel or route of such immigrants. They mostly land in New York, or ports south of us, and find their way into the Western States. Of course they afford relief to that section of the Union, but not to us. It would be wise to adopt some legislative action by which a portion of this tide of population which is now setting so strongly into the country may be turned into our own borders, and for our own benefit. Other people do this to the manifest advantage of their industrial interests. The Canadian Government have long since adopted this course, and have or had a commissioner and other government officials to invite immigrants into the Province, and to attend to their wants when they arrive, and find for them good locations and situations. Such a course has worked well there,—it will work well here.

What we want is an honest and industrious class of immigrants from a country whose climate and topography resembles our own. We want farm laborers, farmers, and working men from the countries of Northern Europe, as the Swedes, the Norwegians and the Danes, who are well known as among the steadiest, most reliable, and most industrious and honest of the European races from which the vast tide of emigration to this country is made up. They are a very desirable people for us to settle upon our public lands, or to receive as farm laborers in our State to supply the wants caused by the recent drains upon our laboring population, to occupy our as yet unsettled domains, and to aid in developing our rich agricultural and mineral resources, and placing our State in the front rank of wealth and political strength.

We can, if we please, send commissioners or agents to the northern sections of Europe, and invite enterprising and thrifty emigrants to turn their course to Maine, and settle on our wild lands. This would insure not only an influx of a hardy and industrious population, which would so far relieve the want of laborers to that amount, but be the means of improving the public domain.

Why not form an Immigrant Aid Society? It is believed that such an association, formed of able and earnest men, using every available means, can make arrangements by which a large immigration may be induced, particularly from Sweden, to settle upon our State lands, and supply our farmers with help, at rates not exceeding the average cost of labor. Other States have associations of this kind, which use their endeavors to divert a portion of the tide of immigration to their respective States, and they have been successful.

It appears by the following extract from the Waterville Mail that a move has been already made to introduce mechanics into this very county of Kennebec:

"A band of English operatives from Lancashire—about forty adults, male and female, with a fair proportion of little folk—came over the Maine Central Railroad, on Thursday, from the west.

They go into the employ of the North Vassalboro' Manufacturing Company, having crossed the Atlantic in the Hibernia for that purpose. Shorter by a head than the average Maine Yankee, they are a hardy, intelligent looking people, and being familiar with the work, will make valuable laborers in the new mills."

At one of the informal meetings of the Board, Rev. Dr. Tefft, late U. S. Consul at Stockholm, being present, remarked that—

"During the last year he had been in a foreign country, and had stood where the sun does not rise for forty-eight hours in midwinter, and does not set in summer for a like period. Sweden and Norway are fifteen degrees farther north than Maine, and yet those countries had proved to him that our Dirigo State, with its snow and ice, can become one of the most fertile places in the world. He spoke of the similarity of the soil and the productions of Sweden and Norway with those of Maine.

We have a large sea coast, the best of harbors, streams in abundance, making the finest mill sites in New England. After traveling throughout the States he was satisfied that Maine possessed the best facilities for manufacturing of any. Sweden was under as high a state of cultivation as any other country in Europe except the British Isles. Though far in the north, the farms look better and the gardens look more productive than any between here and South Carolina. He was thus made to believe that the State of Maine is capable of becoming as productive as Sweden. Why not? We have a milder climate, a little longer season, and a very similar soil. Though we import a great portion of our breadstuffs, Sweden exports annually about 4,000,000 bushels of grain, with a population of only 3,000,000.

We need people only to make us what we ought to be. The State of Maine would to-day have a population of a million if it had retained its young men and women. The current of emigration is now setting westward and southward more than ever; and you cannot make a tide of emigration set east any more than you can make water run up hill. Under these circumstances we must look to Europe for a population. We have depended too long upon the West. There never was so much excitement and desire among people abroad to emigrate as there is to-day. The war has been a great advertisement for us in Europe. They understand that we are a great nation able to protect ourselves against foes external and internal to the end of time. From his experience in Sweden he knew that the Swedes were very desirous of coming over here.

He had had over two hundred applications from smart active young men in a single day in that country to come here at some public expense to be returned by them hereafter.

There are four classes in Sweden—first noblemen, next clergymen, then burghers or citizens, then a wide step to the peasants, who are subdivided into several classes. The servants could all read and write, from the highest to the lowest, yet they are not highly educated. Their education, in whatever occupation they are employed, is of a very finished character, which is the style of all Europe. A man who is educated as a miner knows but very little else; if a farmer, very little besides; but he is thoroughly conversant with his particular occupation.

We cannot depend in this State upon anything which the General Government will do for us in regard to immigration. The United States own vast lands in the West, and none in this State, so they will direct all who come to the West. The Board of Trade in Boston is hard at work to induce immigrants to go to Massachusetts. If we want men to settle the State of Maine, if we want to make labor cheap, we have got to simply help ourselves. The Swedes and Norwegians are accustomed to work very cheap. A man's average wages per day are about 13¼ cents, and they feed themselves out of that. If we would promise them a thousand Rix, or about $250 for the year, and board, he believed that at least half a million would leap at the chance.

He proposed that an agent should be appointed to scatter information among the people, and show them our inducements. This only the United States was about to do, as the bill before Congress did not propose to pay the passage of immigrants. He believed that if a few Swedes could be settled in our State, they would soon draw a great community here.

He thought that we should form an Immigrant Aid Society by which both our State and those poor laboring people can be greatly benefited. We should go to work at once, as we should not for a great while, perhaps never, have so favorable an opportunity as now. The tide of immigration will pass by entirely unless we take measures to turn the stream this way.

The following order was introduced by Mr. Anderson: *Ordered,* That the Secretary be instructed to urge upon the proper legislative committee the importance of encouraging the propagation of fish in our ponds and streams.

Accompanying this order Mr. Anderson submitted some remarks on the importance of employing our waters as well as our lands for the production of food. He had been led to introduce the subject in consequence of a communication received from an old friend, who, although somewhat eccentric, was a man of deep reflection and of original views, and who attached great importance to fishways in all rivers which were interrupted by dams erected for mills. He quoted instances where great benefit had accrued by their use.

Mr. Rogers objected to the order as one irrelevant to the duties of the Board of Agriculture.

Mr. Goodale was glad the subject had been introduced. Some attention had been given to it in this country, but very little compared with France and other parts of Europe. It was there contended by those familiar with results, that an acre of water could be made to yield as much food for man as an acre of land, and with much less trouble and expense. If this be true it is worth knowing and practising here. We have facilities in Maine for Aquæculture in our streams and inland lakes unsurpassed by any other section. The main object of Agriculture is the production of food and it matters not whether it comes from an overflowed rice swamp or from dry upland, from field, garden or lake. We desire to cultivate that part of our possessions which will yield the most profit, and there can be no more valid objection to stocking a pond with fish than a pasture with cattle or sheep.

After some further discussion, in which a general desire was manifested for more light upon the subject, the matter was referred to the Secretary.

The usual complimentary votes having been passed and responded to, the Board adjourned without day.

BONES AND SUPERPHOSPHATE OF LIME.

The subject of Manures is ever one of the greatest importance to the Agriculturist; and now that so large a proportion of the labor of the country is diverted from the channels of productive industry to the preservation of the nation's life and integrity, it assumes a magnitude proportioned to the necessity of growing an adequate supply of food for man and beast, both for home consumption and for the support of great armies in the field, and for doing this with a greatly diminished amount of labor. There is consequently an imperative necessity upon us both to economize labor so far as practicable and to employ all the means which Providence has placed within our reach to increase the fertility of our farms.

The economical management and judicious application of ordinary farm-yard manure, and the utilization of resources less commonly drawn upon, particularly by the more extensive employment of marine manures, have received considerable attention in former reports. I feel, however, that upon one division of this subject, namely, the value and use of bones, something more may be demanded at the present time.

It is said to be less than a hundred years since bones were considered to be of value enough for manure to be used at all. They are occasionally mentioned in books on agriculture as far back as 1770, prior to which I find no allusion to them. About 1812 they began to be saved and used somewhat generally in England. It is said their fertilizing properties when crushed, were first discovered by accident, as follows: The cutlers of Sheffield who used bones largely in the manufacture of handles for knives and forks, threw the refuse of their turnings, scrapings and planings into large heaps, and there remained undisturbed for a long time. At length one of these heaps required to be removed to make way for some new buildings to be erected, and the bone refuse was carted away as rubbish. By mere accident it was spread on grass land, when its fertilizing effect "astonished the natives;" but even then they little thought it was owing to the bone which had been applied, and not a few attributed it to some grand manurial agent *below the surface* before unknown—accordingly they began to dig for more of it, but the results at length led them to the conclusion that the extraordinary crops produced were due to the heap of rubbish which had been spread about. Of course the experiment was repeated, and thenceforward the value of bone dust as an efficient fertilizer became an established fact. The demand increased, old heaps assumed new value, and old pits and holes, into which they had been thrown to fill up, were excavated and every particle saved.

About 1814 machinery was first used for crushing in Yorkshire, and the success attending the operation led to improvements and extension, and soon bone crushing became an established trade.

Bone manure, including superphosphate of lime, has been used to some extent in Maine, and its use is steadily increasing, but by the mass of farmers its value is by no means properly appreciated, nor are suitable measures employed to save and to employ the supplies of this invaluable fertilizer which are within our reach. It is true that in the larger towns agencies are used to collect waste bones, but when gathered, they are nearly all shipped to other States, and only a very small fraction ever finds its way back, in any form, to fertilize our own fields.

The amount of bones annually wasted in the State is considerable. To get some idea of what it is, let us assume that the consumption of meat is half a pound daily for each individual, or less than one-half the army ration, (which was twenty ounces or a pound and a quarter,) and that of this one-sixth part is bone. This would give fifty thousand pounds of bone daily, or twenty-five tons, say nine thousand tons per annum. In a crude state bones have brought, at crushing mills in years past, from ten to fifteen dollars per ton; they now readily command at least twenty dollars, at which price the above named quantity would amount to $180,000. In the same time the price of crushed bones has advanced in an equal or greater ratio, with a constantly increasing demand.

I suppose only a very small proportion of the bones produced here are turned to any better account than the manure which is dropped on the highways. In fact, it is nearly all wasted. This ought not so to be. It is true that in their crude state they are of little use; their fertilizing properties are firmly locked up and unavailable for plants until finely crushed or submitted to chemical processes which may liberate the phosphates contained in them and bring them into a condition in which they may be taken up as food by the roots of plants. We have power enough, labor enough, and skill enough to do this were attention called to its importance, and in no other direction would enterprise tell more effectually upon the production of the State.

The solidity and toughness of bones in their natural state are such as to require powerful machinery to reduce them to fineness, nor do they decay readily, but unlike most other animal substances they dry and harden upon exposure. In this state they are for agricultural uses almost worthless, one bushel of fine bone dust producing more effect than a hundred bushels of whole bones. The question therefore arises whether there be any practicable method by which those who have no access either to a bone mill or a bone market may realize something near their intrinsic value; and in reply I would say there are two methods open to them. First, the bones may be burnt and the ashes applied to the soil. This is a wasteful method because it involves the loss of all the organic matter in the bones, but inasmuch as the bone earth or phosphate of lime is saved and reduced to a condition comparatively available to plants, it is decidedly more economical than losing the whole. Another and greatly preferable way, although requiring more time and labor, is by fermentation. First let them be broken as small as may be with a sledge hammer. Next put down a layer of muck or earth a foot thick, and on this pile the bones in a heap, mixing in horse dung, muck, spent tan, sawdust, either or all, or of some other substance which will retain moisture and gradually decay, enough to fill all the cavities among the bones, and wet the whole thoroughly with stale urine or the drainings of a dung heap, and finally cover the heap with a thick layer of muck or earth. In warm weather decomposition will commence quickly and will progress more or less rapidly as the pile is large and heat and moisture kept up. The larger the heap, the finer the bones, the more stale urine they absorb and the warmer the weather, the more rapid and complete will be the decomposition. Should fermentation cease without sufficient reduction of the bones, the heap may be overhauled and made up again, moistening and covering as before. Should it heat through to the surface and ammonia escape, it should be covered more thickly with muck or earth.

Bone compost successfully prepared by this method contains the phosphate in a finely divided state ready to be taken up by plants, and also all the ammonia furnished by the decomposition of the organic matter. It is an exceedingly valuable manure and the best substitute for a good superphosphate which can be furnished from home resources.

As the use of superphosphate will undoubtedly become more general and extensive among Maine farmers, it will be well to add some farther remarks concerning it.

Phosphoric acid is a never-failing constituent of all plants cultivated for food whether for man or beast, as well as the characteristic ingredient in the bony skeleton of all animals. It enters into the composition of all soils capable of cultivation, and according to the investigations of eminent chemists it is widely distributed throughout inorganic nature, being found not only in the stratified rocks but also in those of igneous origin, as granitic and basaltic rocks, trap and others.* As usually found it exists in combination with lime, and also, but to a much more limited extent, with magnesia and other bases. Prof. S. W. Johnson in a report to the State Agricultural Society of Connecticut, gives so concise and clear an account of the chemistry of the phosphate of lime that I quote here his statement:

"The reader will please bear in mind, that phosphate of lime is in chemical language a *salt,* which means—in a chemical sense be it remembered—a compound of two classes of bodies, the one called *acids,* the other *bases.* These bodies follow the universal natural laws of *combination in definite proportions,* and the numbers expressing their proportions are termed *equivalents.* We can best illustrate this with a body like sulphate of lime, (plaster of Paris or gypsum) which is a salt, consisting of but one acid, and one base, and but one equivalent of each.

---

* "Large amounts of phosphorus are in the course of geological revolutions extending over vast periods of time, restored from the organic realms of nature to the mineral kingdom by the slow process of fossilization; whereby vegetable tissues are gradually transformed into peat, lignite and coal; and animal tissues are petrified into coprolites, which, in course of time, yield crystalline apatite. After lying locked up and motionless in these forms for indefinite periods, phosphorus, by further geological movements, becomes again exposed to the action of its natural solvents, water and carbonic acid, and is thus restored to active service in the organisms of plants and lower animals, through which it passes, to complete the mighty cycle of its movements into the blood and tissues of the human frame. While circulating thus, age after age, through the three kingdoms of nature, phosphorus is never for a moment free. It is throughout retained in combination with oxygen (forming phosphoric acid), and with the earthy or alkaline bases, for which its attraction is intense."—DR. HOFFMAN.

The acid is *sulphuric acid*, its equivalent is	40
The base is *lime*, its equivalent is	28
The salt is *sulphate of lime*, its equivalent is	68

The above becomes intelligible when it is considered that in every specimen of pure gypsum that has ever been examined, the lime and sulphuric acid are present in exactly the proportions indicated by the numbers forty and twenty-eight, and it has been proved a hundred times, that when lime and sulphuric acid are brought together in such circumstances that they can unite, they always do unite in the above proportions. The word equivalent simply means that twenty-eight parts by weight, grains, pounds, &c., of lime, are equal to, or go as far, in making a salt, as forty grains, pounds, &c., of sulphuric acid.

Unlike sulphuric acid, (one equivalent of which usually combines with but one equivalent of a base,) one equivalent of phosphoric acid usually unites with *three* equivalents of base; and these three equivalents may be all of one base, or two of one base and one of another, or, finally, may be all of different bases. What is most remarkable is, that *water* may act as a base; but it is not customary to allow the water to figure in the name of the compound; and in this way, the three phosphates that contain lime and water as the basic ingredients, are all called phosphates of lime. They are distinguished from each other by a variety of prefixes, unfortunately numerous, and none of which are strictly in accordance with the general principles that regulate chemical name-making. The constitution of these three phosphates of lime may be represented as follows:

The first is phosphoric acid (72), lime (28), lime (28), lime (28).
The second is phosphoric acid (72), lime (28), lime (28), water (9).
The third is phosphoric acid (72), lime (28), water (9), water (9).

The equivalents are given with each ingredient, and by adding them together, we find the equivalent of each phosphate.

The first, 72 of acid, and 84 of base, is	156
The second, 72 of acid, and 65 of base, is	137
The third, 72 of acid, and 46 of base, is	118

What is the use of these equivalents? may be asked. In 156 parts (ozs. or lbs.) of the first are 75 parts (ozs. or lbs.) of phosphoric acid: in 137 parts of the second, and in 118 parts of the third, is the same quantity. A simple operation of "rule of three," will reduce these quantities to *per cents.*, and thus we may more readily compare their composition.

Per cent. composition of the Phosphates of Lime.

	1.	2.	3.
Phosphoric acid, - -	46.15	52.55	61.02
Lime, - - - -	53.85	40.88	23.73
Water, - - - -		6.57	15.25
	100.00	100.00	100.00

With regard to the names of these phosphates much confusion exists.

To No. 1 have been applied the names neutral, ordinary, triphosphate and bone phosphate. To No 2, bi-phosphate and neutral phosphate. To No. 3, bi-phosphate, acid-phosphate and superphosphate. No. 1, we may designate as *bone phosphate of lime,* because it is the chief earthy ingredient of bones, or at any rate it remains when bones are burned, and constitutes the larger share of bone ashes. It is almost absolutely insoluble in pure water; but dissolves perceptibly in water containing in solution salts of ammonia, or common salt, or carbonic acid. It is also the principal ingredient of the so-called mineral phosphates;—of *Apatite* that occurs in the iron mines of northern New York, of the *Eupyrchroite* of Crown Point, and the *Phosphorite* of Estramadura in Spain, and of Hurdstown, New Jersey. In the fossil bones, the so-called *Coprolites* of certain districts in England, and in the phosphatic nodules of the silurian rocks of Canada, a variable quantity of bone-phosphate of lime is contained. The phosphoric acid of all the genuine guanos exists mostly in combination with lime as bone-phosphate.

No. 2, most commonly called the *neutral phosphate of lime,* deserves notice as occurring mixed with bone phosphate in the Columbian guano and in other similar phosphatic guanos recently imported.

The agricultural value of phosphoric acid and of the phosphates of lime is well understood. To them bones mainly owe their efficacy as a fertilizer. It is well known that although bones are highly useful when applied to the soil in a coarsely broken state, they are far more valuable if reduced to small fragments, or better still if ground to dust. This is because nothing can enter the plant in a solid form. All that a crop absorbs through its roots must be dissolved in the water of the soil. The bone phosphate of lime is only slightly soluble in water, and is of course very slowly presented to the plant. The more finely it is divided or pulverized, the more surface it exposes to the action of water, and the more rapidly it dissolves. By grinding it is only possible to reduce bones to a gritty dust, fine perhaps to the unaided eye, but still coarse when seen under the microscope. Chemistry furnishes a cheap means of extending the division to an astonishing degree, and enables us to make bone manure perfect both in its mechanical and chemical qualities.

This brings us to No. 3, or *superphospate of lime,* which is the characteristic ingredient of the genuine commercial article known by that name, in which, however, it is largely mixed with other substances. Its peculiarity is ready solubility in water. It may be prepared from either No. 1 or No. 2 by adding to these phosphoric acid, or by removing lime in presence of water. In practice lime is removed.

If to 156 parts (one equivalent) of bone phosphate of lime we add 80 parts (two equivalents) of sulphuric acid,* with sufficient water to admit of an intimate and perfect mixture, then the 80 parts of sulphuric acid take 56 parts (two equivalents) of lime and form sulphate of lime, while the phosphoric acid retains 28 parts (one equivalent) of lime, and 18 parts (two equivalents) of water replace the lime removed by the sulphuric acid, so that there results 136 parts of sulphate of lime, and 118 parts of superphosphate.

The manufacture of good superphosphate of lime, consists essentially in subjecting some form of bone phosphate of lime—it may be fresh or burned bones, mineral phosphates or phosphatic guanos—to the action of sulphuric acid. The product of such treatment contains sulphate of lime, superphosphate of lime, and still a greater or less share of undecomposed bone phosphate, together with some free sulphuric acid, because the materials cannot be brought into such thorough contact as to insure complete action.

The reader can easily perform a simple experiment that illustrates the change which superphosphate of lime, or any soluble phosphate, always undergoes when brought into the soil. Stir a spoonful of superphosphate in a tumbler of water; let it settle and then pour off the clear liquid into another tumbler, (if no superphosphate is at hand, use instead of the liquid just mentioned,

---

* *Oil of vitriol* consists of about 75 per cent. of pure sulphuric acid, with 25 per cent. of water.

strong vinegar in which some bits of bones have stood for a few days.) Now stir a few lumps of salæratus or soda, in water, and pour it gradually into the first liquid. Immediately a white cloud, or *precipitate*, as the chemist calls it, is formed; at the same time the liquid will foam like soda water, from the escape of carbonic acid gas.

This white cloud is *precipitated bone phosphate of lime*, and does not essentially differ from the original bone phosphate, except that it is inconceivably finer than can be obtained by any mechanical means. The particles of fine bone dust will not average smaller than one hundredth of an inch, while those of this precipitated phosphate are not much more than one twenty-thousandth of an inch in diameter as shown by examination with the microscope.

Since the particles of the precipitated phosphate are so very much smaller than those of the finest bone dust, we can understand that their action as manure would be correspondingly more rapid.

In fact, the application of superphosphate to the soil is always speedily followed by the formation of this precipitated phosphate: the iron, lime, potash, &c., of the soil having the same effect as that produced by the salæratus or soda in the above experiments. The advantage of dissolving, or rather acting upon bones with sulphuric acid, is then not to furnish the plant with a new food, but to present an old dish in a new shape more readily accessible to the plant. In addition to the advantage of *subdivision* thus presented, another not less important is secured, viz., *distribution*. This may be illustrated as follows: If one part of a quantity of superphosphate be mixed with chalk, lime, or ashes before use, while another portion is directly applied, in both cases precipitated phosphate will be furnished to the soil. The *subdivision* will be equal, but the *distribution* will be unlike. In the first case, the ready-formed phosphate is very imperfectly mixed with the soil by the mechanical operations of tillage. In the latter instance, if the superphospate be scattered on the surface, it is unaffected until a rain falls upon it. Then the superphosphate dissolves, and trickles or soaks down into the soil, meeting here with a particle of lime or potash, and depositing a particle of bone phosphate, travelling on a little way and depositing another, and so filling the whole soil to a certain depth with the precious fertilizer.

It seems then that it is important not only that the superphosphate be *made*, but that it *remain* such until strewn on the soil. I would suggest that the simplest, and for agricultural purposes the most accurate way of designating the phosphates of lime, and all other phosphates, is to divide them into two classes, *soluble* and *insoluble*, and always to base calculations on the *phosphoric acid* they contain, because it, and not lime or water, is the valuable ingredient of them all."

It should be clearly understood that the commercial article sold as superphosphate of lime is not the pure chemical substance which properly bears this name, for, as remarked by Prof. Johnson in the above quotation, it contains sulphate of lime and other substances. It is more properly a compost which contains a considerable and distinguishing proportion of superphosphate, and which has been prepared in such a manner as to afford the soluble phosphate in the cheapest form in which it can be procured for agricultural purposes. To buy the chemically pure article to apply to the land would be like purchasing pure caustic potash when this alkali was required for manurial purposes, instead of using unleached ashes, which would supply it at a greatly cheaper rate. Sulphate of lime or gypsum is necessarily present in considerable quantity, because this substance is formed in the very process by which insoluble phosphate is converted into soluble phosphate. It is well if no extraneous substances are added purposely to adulterate it and cheapen its cost. Partly owing to the fact that the superphosphates of commerce are a sort of compost, there is no other fertilizer which so easily admits of adulteration and fraud, and there are no other means of assurance of genuineness than a careful and thorough analysis. Actual trial will prove its success or failure in any given instance, but this result may depend not a little upon the soil, or season, or crop, or manner of application. Simple inspection, however critical, without chemical testing, will give no clue whatever to its quality; and yet of all the artificial manures which have been prepared and used, this is the only one the use of which has steadily increased from the time when it was first announced by Liebig in 1839, now twenty-five years ago. From being sparingly made and cautiously employed, its consumption is now to be reckoned by hundreds of thousands of tons. The best article is made from raw or unburned bones, but the supply of these is altogether inadequate to the demand, and the price they bring when merely crushed to coarse powder is such that little inducement exists to convert them into superphosphate. Probably more than nineteen-twentieths of all which is sold is made from phosphatic guanos, sugar refiners' spent bone black, bone ashes from South America, and from mineral and fossil phosphates.

To give some idea of the extent of the manufacture, it is stated on good authority, that not less than one-half of all the oil of vitriol made in Germany is used to make superphosphate, and in this state is applied to the land! As might be supposed under such circumstances, there have been extensive frauds in its manufacture and sale, large quantities of worthless trash having been sold in its name. Many men, both ignorant and unscrupulous, have embarked in its preparation, and as a very inferior article may look as well as the best, very serious impositions have been endured by the buyers.

Of late years the practice has prevailed in England of selling by analysis with a guaranty that the bulk equals the sample; and there as well as elsewhere, in the long run, honesty vindicates its claim to be deemed good policy. Those who cheat lose their customers after a while, and the business gradually and naturally centres in the hands of a comparatively small number, who by honest dealing, connected with sufficient skill, energy and capital, are able to do a remunerative business, make a uniformly good article and sell at fair prices.

During the present year the commercial value of superphosphate has been so considerably enhanced by the advance in sulphuric acid, (necessarily used largely in its manufacture,) that many farmers will deem its present price a prohibitory one. This being the case, I would call special attention to the fact, that within a very recent period, by means of new and improved machinery, bones have been reduced to a state of greater division than heretofore, and that an article is now to be found in our markets called "Flour of Bone," so very fine as to be much more readily soluble than ordinary crushed bone, and so, of course, more readily available by the roots of plants.

It would seem probable that this article may, to a considerable extent, supersede the superphosphate, and from a limited experience of its use during two years past, in comparative experiments with other forms of phosphatic manures, I have been led to the opinion that it is worthy of extensive use, as furnishing phosphate of lime in a form more economical than any other as readily available to the uses of vegetation.

AQUÆCULTURE.

This is rather a new subject to the farmers of Maine. It is comparatively new to proprietors elsewhere. The prime object of Aquæculture being identical with that of Agriculture, to wit: *the production of food,* it has, as is very natural and proper, attracted, from agriculturists abroad, a degree of attention in some measure commensurate with its importance.

Not many years ago, Lavergne, in his excellent work on the Rural Economy of Great Britain, wrote as follows: "The object of all cultivation is the production of the greatest possible quantity of human food upon a given surface of land; to attain which object widely different means may be adopted." Had he written now, he might probably have omitted the words "of land," or have added "and water." The principle here asserted is a very just one, and a wise policy will ever seek for the method best adapted to the end in view, whatever may be the field of operations, whether dry land, wet land, running stream, lake or ocean.

Where the surrounding conditions are more favorable to the production of herbage than of cereals, cattle and sheep will be preferred to grain crops, and vice versa. There are, as we all know, many cases where a mixed husbandry is preferable to either grain alone, or stock alone; and if it be true, as alleged by those who are entitled to credence and profess to know whereof they affirm, that under favorable circumstances an acre of water is capable of producing annually as much value of food as an acre of the best land, with less labor and less risk of exhaustion, and as Maine has apparently great advantages for its prosecution, it seems advisable for us, at least, to investigate the claims of aquæculture, and to learn something regarding its methods.

At the last session of the Board, the subject was introduced, and a general desire manifested to have more light thrown upon it. I had proposed to myself to furnish a paper on the subject and had collected some materials for the purpose, but being prevented from doing so, I am happy to more than supply its lack by one from the pen of our veteran agricultural friend, Dr. E. Holmes of Winthrop, who undertook the task *con amore,* and to whom the subject in some of its aspects has long been familiar, inasmuch as he has bestowed study and observation upon it for years past.

The paper is presented with the hope and expectation that it may accomplish something among us toward the hastening of the time when the dominion decreed to man, at the creation, over the fish of the sea, shall be more successfully asserted than it has ever yet been; when the command "Let the waters bring forth abundantly" may *by the coöperation of man,* be more fully responded to. Its facts and suggestions, and especially with regard to the feasibility and pecuniary profit of an increase of the *Salmon crop,* are commended to thoughtful consideration:

AQUÆCULTURE.

"Practical Physiology will exercise its empire over organic matter by an applica- of the laws of life."—Coste.

Aquæculture bears the same relation to the water, that Agriculture does to the land, and like Agriculture, involves the knowledge and practice of obtaining from it in the most efficient and economical manner, its products both vegetable and animal.

There is this difference, however, water, being an element in which man cannot live, he can have direct supervision only on the surface, or in comparatively shoal parts of it. There is also another difference depending principally on the character of the products, and that is, but very few of the vegetable products which grow wholly submerged in the water are used directly by man for food. Hence the attention of man has been almost exclusively given to the animal products which exist in the waters, not only of the ocean, but of the interior streams and lakes. Although mankind have obtained large amounts of sustenance from this range of animal life ever since God gave them "dominion over the fish of the sea," it is but a few years since attention has been directed to any methods of guiding and aiding the propagation of fishes by artificial means, or in artificial reservoirs, in accordance with the natural laws of fish breeding as developed by observation and close study of their natural history. It is true that the Romans, according to the accounts of Columella and others, did something in this line, but their labors were principally confined to the construction of artificial fish ponds, in which certain species were enclosed and fed daily to increase their size and fatness, and in which they bred in the natural way, without any special interference from their keepers.

The Chinese claim to have practised the art of artificial fish-breeding a long time before the Romans did. Indeed, they declare in regard to this business, that, like all other branches of industry among them, it has been practised there "from time immemorial." I have no authentic documents which establish their claims to such ancient priority, and their history is made up of such a mixture of fact, fable and romance, that we hardly know what reliance to place upon their claims to so much knowledge and practical skill so long ago in what are now considered modern arts.

Jacobi, a German naturalist, and a very close observer of the instincts and natural habits of animals, about a century ago (1763) promulgated the doctrine that the propagation of fishes could be carried on by artificial means; that the eggs of fishes were impregnated and fertilized by the absorption of the male sperm through their outer coatings, and that, by pressing the female when her ova were at a mature stage, they could be received into vessels of water, and by mingling with this water the "milt" of the male, obtained in the same manner, the eggs became impregnated, and if then placed in situations similar to what the parent fish would place them, they would hatch, and thus by following out the requirements of the species when in a state of freedom, could be reared with ease in any numbers.

This was a very interesting and important discovery. A few establishments for fish-breeding in this manner were at that time made, but it would seem more for the demonstration of the fact that such a thing could be done, or for the gratification of curiosity, than for any practical use or benefit, as the system did not come into very extended use, and was, for many years, discontinued—the facts only remaining on record as among the known laws of this branch of natural history.

It thus remained dormant until about the years 1835 to '40, when it may be said to have been rediscovered and put into successful practice by two fishermen of Bresse, in the department of the Vosges, in France—Messrs. Gehin and Remy. These men were in all probability ignorant of the discoveries of Jacobi. They followed fishing for a living, and by long observation of the different species of fish, especially of trout, they obtained a knowledge of the same facts and laws that he had discovered, and they forthwith put them in practice for the purpose of making them profitable in their business. They succeeded so well that the art began to attract the attention of others who had more leisure and capital to carry out subsequent discoveries, and fish-breeding has now become a regular and systematic business in many sections of Europe, and as firmly established on a regular basis of philosophical facts and pecuniary capital as any other.

To this latter condition of the art the world is much indebted to Prof. Coste, who, learning what the Messrs. Gehin and Remy had done and were doing, visited them and for a time became their pupil in the art. M. Coste was Professor of Embryogenie in the College of France, and having become satisfied with the practicability of the business as fully demonstrated by the operation of Gehin and Remy, by his influence with the Emperor obtained from the French government a grant of 30,000 francs ($6,000 nearly) for the purpose of establishing the business at Huningue, with a view of instituting experiments and making such further observations as would tend to develope all the laws by which nature governs the propagation and rearing of such species of fish as could be obtained.

Many valuable facts have thus been brought to light. Other institutions of the kind have sprung up and multiplied in other parts of the world. Eggs of fishes are now obtained, impregnated and carried to any distance to places where needed, as easily and safely as the eggs of hens or ducks.

A knowledge of these facts very naturally prompts the question, why not introduce such fish-breeding establishments in Maine? Our territory furnishes every facility for such enterprise. Our seaboard is known as furnishing one of the best marine fisheries in the world, and our many inland lakes, with their rivers and minor streams, were once the haunts of innumerable fresh water species, and of the migratory kinds of fishes also, that at different times and seasons changed their location from lake to ocean and from ocean to lake, according to the promptings of their habits and instincts.

No part of the Union afforded the aborigines a greater and more abundant source for game of this sort, than did Maine, and for years the products of the lakes and streams afforded to the early settlers a large and unfailing supply of subsistence, and in many instances prevented the effects of famine, from the lack of provisions occasioned by the failure of harvests or the ravages of the Indians. It is not so now. The improvements of civilization by the clearing up of the forest and the construction of dams and mills, have very materially interfered with the natural habits of this latter class, and diminished their numbers, in some places completely destroying them and thereby a great supply of this variety of food.

These obstructions have, undoubtedly, indirectly an influence on the productiveness of many marine species. As the great diminution of the supplies of this species of fish has been caused by artificially interfering with their natural course of life, it certainly becomes a legitimate object both of science and art to restore the supply, by studying into their habits, ascertaining what they require, and restoring to them such means for breeding and feeding as their natures crave.

For this reason I have thought it not only expedient, but that it would be highly useful as well as profitable to call your attention to the business, and give a few details of the best modes of conducting it, and have divided my remarks into two departments, viz., Marine Aquæculture and Interior Aquæculture.

PART I.—MARINE AQUÆCULTURE.

Under this head would naturally be embraced an almost boundless variety of subjects, including as it does the production of all the marine plants, as well as the immense number of species and varieties of animals with which the ocean is filled.

In the report of 1861, the consideration of such marine plants as were found most abundantly on our shores, and their uses as material for manures, and their preparation as fertilizers, were presented. Your attention is now called to only one topic out of the many, which presents itself under the range of oceanic animals, and that is, the production of the oyster.

The coast of Maine, or rather some parts of the coast, was once a rich and prolific oyster bed. This is proved by the presence of oyster shells still found in the mud in many places, but more decidedly by the great accumulation of shells in some places on the main land, especially in Damariscotta and Newcastle.

Prof. Hitchcock says that the remains of two species of oysters are found on the coast of Maine, viz., the *Ostrea borealis* and

Ostrea Virginiana.[*] It is a fact that however productive these beds were formerly, but few oysters are found on the coast now. What has occasioned this change is not certainly known. Many philosophical conjectures have been brought forward to account for it. One theory, and perhaps as plausible as any, is that there has been a change in the flow of the Gulf Stream, it formerly having been nearer the shore than now, and thereby causing a warmer temperature of the water on the coast than there is at present. How near the truth this conjecture is, cannot now be definitely settled for the want of data to determine several points of inquiry connected with it. We have no record of the average temperature of the water at different locations on our coast, either at the present or any former time. Observations are being continually made on the land in regard to the average temperature of different locations, and these observations have been the data for establishing a range of isothermal lines. That similar lines, or rather that the theory of isothermal lines, pertain also to the ocean as well as to the land, cannot be doubted, but years of careful observation are required to trace them out. Again, it is not yet well settled what is the average temperature of water, all other things being equal, to ensure the greatest product of an oyster bed. That the different species of animals in the ocean require different temperatures to enable them to flourish and come to the greatest perfection, is as true in regard to them as it is in regard to land animals. Every one knows that many birds migrate from our climate to the South, on the approach of winter, and return in the spring for the purposes of breeding during the warm seasons of our summers. Many fishes also do the same.

"The whale is only to be found within a certain space of the Gulf Stream, which it avoids as if it were a fire stream, and a little pamphlet on the herring fishery, translated from the Dutch by order of the Board of Trade, shows that herrings seek such parts of the North Sea as are not colder than 54 degrees nor warmer than 58 degrees, thus teaching fishermen within what limits they may profitably ply their calling."[†]

Different species of shell fish undoubtedly require peculiar degrees of temperature as a condition of healthy production, and to this rule the oyster cannot be an exception. Two things are true in regard to it, viz., it was once very abundant on our coast; it is not now. What average temperature it requires has not been settled by any experiments to my knowledge. Francis, in his work on fish culture, casually remarks that "one of the worst foes that oyster bed proprietors have to dread is frost, which destroys vast numbers in the shallow waters." This is on the coast of England. Still, he says "the profits are very large, and the subject is well worth the attention of proprietors by estuaries, sea-lochs and such localities as are favorable for oyster beds."

---

[*] See Report of Scientific Survey of Maine for 1861, p. 292.

[†] Highland Journal of Agriculture, 1861 to 1863, p. 274. What is called the "English herring" is here referred to.

I take the liberty to say the same to the shoresmen of Maine. Whatever may have been the real cause of the decrease of oysters in our own waters, there are undoubtedly many locations where, with care and attention, they may be now successfully propagated. This is evident from the fact that they do still exist here. That they would be a profitable production is abundantly evident, although I have no statistics in regard to the amounts brought from abroad and sold among us.

How Oysters Produce their Young.

Before going into details respecting the best mode of breeding oysters, it will be well to consider the natural laws of their reproduction. It is a common remark among fishermen that oysters and clams are unwholesome during any month that has not an R in the name of it. Now the innocent letter R can have no influence, but it so happens that the months of May, June, July and August are destitute of this letter, and they are the very months in which oysters breed. In May, they begin to grow milky. The season of spawning is from June to September, sometimes to the end of September. But in spawning they do not leave their eggs like many other animals. A very accurate writer thus briefly but clearly describes the process:

"They incubate them in the folds of their coverlet within (or mantle) and among the layers or laminæ of their lungs (branchiæ, as anatomists call them.) There they remain surrounded by mucous matter necessary to their being developed, and within which they pass to the embryo state. The mass of eggs (*ova*) in consistence and color resemble thick cream, and breeding oysters are therefore called "*milky.*" The pale tint which characterizes them, gradually in the process of development changes to bright yellow, then to a darker yellow, and ends in a greyish brown or very marked greyish violet. The whole mass, which meanwhile is losing its fluidity, probably by absorption of the mucous matter enveloping the ova, is then like a piece of compact mud. This indicates the near termination of the development and expulsion of the embryos and their independent existence; for by this time they can live well enough without the protection of the maternal organs. On leaving the mother they are furnished with swimming apparatus, (its singular nature has been described by Dr. Davaine,) enabling them to move to a distance in search of solid bodies to which they may attach themselves.

The oyster produces not less than from one to two millions of young, so that the animated matter from all the adults of a breeding bank, or oyster bed, is like a thick mist dispersing from the central spot from which it emanates, and so scattered by the waves that only an imperceptible portion remains near the parent stock. All is dissipated, and if these myriads of wandering animalcules, borne about by the waves, do not meet with solid bodies to which they may attach themselves, their destruction is certain ; for those that do not become a prey to the lower creatures that live on the *infusoriæ*, fall at last into some place unsuitable to their future development, and are frequently smothered in the mud."*

Apparatus and Fixtures Convenient or Necessary to Preserve and Protect the Young Oyster.

We have seen by the above description of the breeding process of the oyster, that the incubation is carried on within the shell of the parent, and you can do nothing until the young are hatched and sent forth in a living state, but so small in size that they appear like a mist in the waters. Then is your time to interfere and use your skill in catching and holding these *misty* particles in some safe place. Remember what has just been said—"*if these myriads of wandering animalcules, borne about by the waves, do not meet with solid bodies to which they may attach themselves, their destruction is certain.*" The duty of the oyster breeder is therefore obvious. He must place solid bodies, that these animalculæ, these almost invisible oysters, shall meet and *stick to.*

The requirements, in short, are these. Select some suitable location where there shall not be any very swift currents—no violent waves—water of suitable depth to insure neither the extremes of the cold of winter nor the heats of summer, and where there shall be no shifting about of the soft ooze at the bottom, nor contamination of the water by accumulations from mines or manufactories. Procure oysters on or before the month of May, and deposit them. Then place framework of wood, or hurdles like fish wiers, around or among them, which the young floating oysters shall meet and adhere to. Yankee ingenuity will not be slow to contrive fixtures for this purpose, and applicable to the location where they are wanted. I will however copy from different sources the description of apparatus successfully used for this purpose.

---

* Highland Journal of Agriculture, 1859, p. 96.

In Italy, there is a salt lake called Fusaro,* which has been for many years used for the artificial breeding of oysters with great success and profit. We have none like it in Maine, but the system adopted there may in part be adopted in many places on our coast. Francis says it is about a league in circumference and from three to six feet deep in the middle. The bottom is muddy and is dotted over with large stones or fragments of rocks to which the oysters attach themselves. Round about these stones, large stakes, which project above the water, are stuck into the soil, not so tightly, however, but that they can be withdrawn. From these stakes to others extend cords or lines, and from these cords, at intervals, are suspended faggots, to and among which the spawn of the oyster, when first hatched, can attach and ensconce itself until safe from any outward danger. The use of these faggots and stakes is important, as when the young of the oyster is first hatched, it scatters in all directions, until it finds something to which it can safely attach itself. * * When about three years old the oyster becomes edible, and is ready for the harvest. When they wish to gather them they break off by means of hooks those which are attached to the rocks, or, by pulling up the stakes and faggots, pick off those by hand which are large enough, replacing the others again in the water to grow for future gathering.

Under the patronage of the French government M. Coste has been engaged in replenishing the almost exhausted oyster beds on the coast of France, and establishing others in places where none grew before, and so successful has he become, that millions are now annually gathered where none were found before. In all these operations he has adopted the use of frames of timber and plates of hurdles and faggots sunk to the bottom of the water or suspended by lines and ballast a few feet above, for the purpose of intercepting and catching the spawn—"spat" as it is sometimes called—and retaining it in a place of safety until matured and ready for market.

---

* This lake is of volcanic origin, and was the famous Acheron of Virgil.

In the island of Re, on the French coast, Dr. Kemmerer has adopted the following plan to intercept and save the oyster spawn. He covers a number of tiles with a coating of mastic, brittle enough to peel off with the young oysters on it. When this coating is well covered with spawn, he gets it off in one piece, and deposits it in the place where he wishes the oysters to grow, and uses the tiles again in the same way as long as the seeding season continues. Thus you see that almost any arrangement which will intercept the floating spawn or "*spat*" of the oyster, if placed in a convenient and proper position to favor their future development, answers all the requirements of successful oyster culture.

Are there not thousands of such places on the coast of Maine, now comparatively unproductive, that, with very little capital and labor, might be converted into rich and productive oyster banks, affording innocent and nutritive luxury to the community and remunerating profit to the proprietors?

Muscle Culture.

Muscles are abundant on our coast, and as little or no use is made of them, it may provoke a smile, perhaps, if we devote a few remarks upon the mode of cultivating them. I wish merely to observe that the same fixtures and operations required in oyster culture will insure success in rearing the muscle. Although they are considered of no value with us, in other parts of the world they are prized as an article of food,* and are also gathered by cargoes to supply bait for fishermen when in pursuit of cod and other sea fish. In many places on the coasts of Scotland and France the gathering them by dredging and preparing them for bait makes a large business. But dredging is a laborious and unpleasant work, and it may not be amiss for any one to know, that if it should ever be an object among us to obtain them in quantities, they may be raised, as has been said, in the same manner as has been described above in remarks on oyster culture. They can thus be made to propagate where they can be gathered by hand with comparative ease and dispatch.

---

* To some stomachs and constitutions the muscle is injurious, but the French, who are fond of them, say this is owing to their being bred in foul docks among poisonous solutions of copper-bottomed ships, which impregnates them with deleterious properties, but those reared on hurdles are very different both in flavor and nutritive properties.

A writer over the signature of D. E., in the Highland Journal of Agriculture, (1859 to '61,) quoting in part from M. Coste, gives the following sketch of the process of muscle breeding on hurdles at Commachio, in the bay of Aiguillon, in France. It seems that they become milky there two or three months earlier than the oyster. The seed, as he calls the young muscle, is fixed in February. Towards the month of April, he says the *seed* fixed in February and March to the single stake is scarcely the size of a lint (flax) seed. In May it reaches the size of a lentil; in July that of a French bean, and in this stage they transplant them. At this season the muscle gatherers detach the young from the stakes by means of a rake with a handle, and proceed to fasten them, one bunch after another, (each wrapped in a piece of old net,) among the branches of the hurdles, care being taken, however, that each separate bunch shall be at such a distance from the next one, that when grown they shall not mutually incommode each other. The net soon rots and thus presents no obstacle to their expansion. In the end they have grown so much as to touch each other. Arrived at this stage, they can be weeded in order to afford room for younger generations, and may be picked out, wrapping each bunch as before in a piece of net before consigning them to their new *habitat*. At the end of twelve months they are marketable. They then undergo their last transportation to the in-shore hurdles, where they are at hand any time, and do not suffer, though the sea leaves them dry twice every day. It is a singular fact, he remarks, that muscles growing together on the same hurdles do not all possess the same qualities. Those on the highest rows are better flavored than those on the middle rows, and the latter are deemed inferior to those lower down, which are covered with mud whenever the waves agitate the bottom. But M. Coste affirms that even the least esteemed of these are preferable to the finest gathered in the sea.

Before closing this part of our remarks on marine aquæculture, it may be well to call attention to two other species of bivalves found and in much esteem on our coast. These are the common clam (*Mya arenaria*) and the quahog (*Venus mercenaria*). The former is abundant, the latter rather scarce. They are both self-generative, but I know of no experiments instituted for the purpose of multiplying them by a course of culture. As they live imbedded in the sand, each in its own domicil, the process of culture must of course be different from that of the oyster or muscle. And here let me observe is a new field of research and discovery for some of our young and enterprising shoresmen. Will some of them enter and let the world be benefitted by the new facts which their labor and ingenuity may develope?

PART II.—INLAND AQUÆCULTURE.

Having spoken of one branch of Marine, or rather Maritime Aquæculture, I will now call your attention to a branch of Inland Aquæculture.

Everybody in Maine has heard how productive of various kinds of fish our numerous rivers, lakes and streams used to be in olden times. Many of you can still remember how plenty and cheap salmon, shad, alewives and other fish used to be, and with what facility they were taken, and how much they added to the subsistence of the people.

An aged woman, who formerly lived on the banks of the Kennebec in Vassalboro, and who, at that time, had a large family of children to support, once told me that, in spring and early summer, the fish from the river were a very essential aid to them—that many times she has sent one of her boys down to the river early in the morning to catch a salmon for breakfast, with as much certainty that he would bring one home in season, as if she had sent him with the money to a city fish market, where she knew they were kept for sale.

Every one now knows that salmon, shad and alewives, and indeed all the other kinds of migratory fishes—those that spend their winters in the salt water, and come up out of the sea at certain periods, as if sent by a kind Providence, to spend the spring and summer in fresh water—are now very scarce indeed, and in some streams totally extinct. Every one knows, too, that many of the species of fishes which remain permanently in our fresh waters, have very much decreased in numbers, as well as in size and fatness. People say that this is a necessary consequence of the building of dams and mills, and filling the streams with obstructions of various kinds required for the industrial pursuits of a civilized community. No doubt it is a consequence of these obstructions, but it need not be a *necessary* consequence. I hold that dams and mills might be constructed, and continued, and yet by a little concession on the part of dam and mill proprietors, and a more general diffusion of the knowledge of the natural history of fishes, more intimate acquaintance with their peculiar habits, instincts, and wants of life, the mills might remain and the fish continue to perform their annual pilgrimage to and from their breeding haunts, if not in so great numbers as in former times, yet in such numbers as to afford a vast amount of provisions and even luxury to the communities which are now wholly deprived of them.

I am aware that this subject has been discussed over and over again—that for years and years past, every session of our Legislature was thronged, and committees were worried and teased by mill owners on the one hand and fishermen on the other—one demanding the privilege of building dams and mills without let or hindrance as to the fish, and the other pleading for some reserve, some fish-way, or some accommodation to the annual flow of fish, which had been of such signal service to the support of the people on the banks and vicinity of the waters in question. I am also aware that our Legislators, actuated by a sincere desire to do justice to all parties, and to give equal rights to all, have, in most instances, made provisions in the several charters and private acts pertaining to mill owners, for the passage of fish at certain times and seasons, with a hope that, while it encouraged the establishment of mills and machinery, there would also be at the required times a safe and successful transit for the various species of fishes that required such passes as one of the indispensable requirements for the continuation of their existence. And we are all aware also that, either from ignorance of what the habits of the fish demand, these ways have not always been properly constructed,* or from selfishness in mill owners in not keeping them open at suitable times, these provisions have in most cases failed, and the destruction of the fish is the inevitable result.

---

* The charter granted to the Augusta Dam Company required that suitable provisions should be made for the passage of fish. When the dam was built, it was thought by the engineer and others, that a long inclined plane extending from the pitch or brow of the dam to the bottom of the river below, over which the water could flow with a steady, uniform current, would not only allow fish to ascend, but also render a better passage of logs, and make the dam more firm and secure. The results did not meet these expectations. The fish could not go up so long an uninterrupted sheet of water. The logs often in low stages of water grounded and stopped by the way, and the water at the foot of the dam, by its revulsion or sud-

Notwithstanding this discouraging state of things, it does seem to me that, by proper attention to this business, and by a more general spread of the knowledge of the system of artificial breeding of fish, and careful provision being made to enable them to carry out the dictates of their natural instincts, these kinds of fish might again be introduced into the waters which formerly swarmed with them, and a supply of them afford, as of old, an annual and rich return for the care and labor they would require. This has been successfully done in other countries, why cannot it be equally as well done with us?

I am the more sanguine that this can be done in all our rivers and streams which they naturally inhabited formerly, because of the partial success that has attended the keeping open perfectly constructed fish-ways in a few parts of the State.

Experiments have been successful in some other States, by which some streams and lakes have been stocked with fish of kinds never known there before, and others again filled from which the fish had been driven by the obstructions thrown in their old pathways, with no means given by which they could surmount them.

It will be well, however, before going into detail in regard to the artificial propagation of fish, or of the replenishing exhausted lakes and streams, to examine some points of the natural history of the species proposed to recommend for propagation, and thereby

---

denly checked momentum, dug under and began to undermine, and the apron had to be removed and the water allowed to pitch over perpendicularly. This saved the dam, but no fish-way was provided, and the fish for years kept back, until a new "*fight*" was made in the Legislature, and a fish-way opened near the bottom of the dam.

The fact is, that fish cannot ascend a long continuous pitch or cascade of water. We formerly have frequently watched the movements of salmon when ascending the Ticonic Falls on the Kennebec at Waterville in the spring of the year. They invariably selected those portions of the falls that were most interrupted by breaks or steps of the ledge forming little basins at different stages in the fall. They would fetch a spring and go up a pitch of water almost perpendicular for four or five feet, and then rest themselves some time in the basins preparatory for another spring, and so continued their operations until the last pitch was scaled and they reached the smooth water above the falls. This fact indicates that if a direct passage could not be made in a dam, a series of short falls or steps would meet the requirements of the migratory fishes.

become better prepared to conduct the business more understandingly, and more in accordance with their natural requirements.

Salmon (Salmo salar.)

The largest and most valuable of the migratory tribe of our fishes, and the loss or scarcity of which is most severely felt, is the salmon.

The study of the habits and instincts of the salmon has been more carefully and thoroughly pursued in England and Scotland than in this country. From facts developed thereby, it appears that there are some peculiarities in regard to their natural habits in the English waters, and probably everywhere, which render them very different, as far as is known, from the characteristics of other fish.

According to the observations of Mr. Brown of Scotland, who has made the natural history of the salmon a special study, and who has published a very pleasant and interesting book upon the subject,* the young fry, in the first stages of its growth, cannot live in the salt water. The fishermen in that section of Great Britain enumerate several stages or periods of growth in the salmon, for each of which they have a distinctive name. In its first stage, they call it "parr." In this stage its scales have not grown, and it is so different in appearance from what it is at the next older period, that it was long considered by fishermen as a distinct species of fish, having no connection with salmon. This stage, or period, continues generally about one year, but it is a little remarkable that all of these "parr," even of those hatched at the same time, do not all change at the same time. Some of them continue in the "parr" state a year longer. In the next stage, or period, they are called "smolts." The scales and many of the specific forms and colors of the salmon now show themselves, and all acknowledge them to be the veritable young salmon. During this stage, there seems to be some interior physiological as well as external change. Instead of its being unable to live in the salt water, it now seeks for it, going down the rivers to the ocean, and remaining there during the winter. After remaining absent a few months, a portion of them return, much enlarged in size, though not of full growth. They are then called "grilse." In this grilse stage they have become sufficiently matured to breed, and they seek the cool head waters of clear and gravelly streams for the purpose of depositing their spawn in those places. But, as in the case of unequal change of the "parr" to "smolts," there is a similar inequality in the change from "smolts" to "grilse," some of them remaining until the next year before they appear, when they come as full-grown salmon, instead of coming in the "grilse" stage. There is another peculiarity observable in them. Besides being unable to live in the salt water while in the "parr" stage, it is remarkable that, young as it is, the male parr is capable of impregnating the ova of the "grilse" or more matured salmon. We quote from Mr. Brown's work a few of his remarks in corroboration of the above statements. The fact that the fry of the salmon, in its "parr" state, cannot live in salt water, was tested by him by putting some "parr" into the salt water. "Immediately on being immersed in it, the fish appeared distressed, the fins standing out stiffly, the parr markings becoming of a brilliant ultra marine color, and the belly and sides of a bright orange. The water was often renewed, but they all died, the last living nearly five hours. After being an hour in the water, they appeared to be weak and unable to rise from the bottom of the vessel which contained them, the body of the fish swelling to a considerable extent." He then took eggs which had been previously manipulated upon, and dropped them into sea water, which destroyed them almost instantaneously. He then put "smolts," which had had on their scales for some time, into the salt water, directly from the fresh water, and they seemed to enjoy it as if they were in their true element. These facts, he observes, "prove that until the parr is covered with the new scales, it is unable to live in salt water, and also that salmon cannot hatch or breed in the sea."

---

* Natural History of the Salmon, as ascertained by the recent experiments on the artificial spawning and hatching of the ova and rearing the fry at Stormontford, on the Tay. By William Brown. Perth-Glasgow: 1862.

In regard to the precocity of the male "parr" as to its power of impregnating the ova of the "grilse," and older salmon, while the female "parr" has to undergo the changes before mentioned, Mr. Brown observes that, "why those parr that remain behind in fresh water for another year do so, we cannot tell, but such is the fact, and the best reason we can give is, that by this means the river has always fish in it that will migrate at least a month sooner in the spring than the fry of the first year, and also that males will be always at hand in the river, during the spawning months, in a fit condition to supply the want of male salmon, when that occurs. This is a wise provision of Nature, as many females, in small and distant tributaries, might be left without a male if there were no parrs, male parrs having been proved to be in a breeding state at that time." This fact has been often demonstrated by trial of them in the artificial impregnation of the eggs of the matured salmon.

Process of Spawning.—I have never had an opportunity of witnessing the spawning operation of the salmon, although I have made several excursions to the head waters of the western rivers of Maine at various seasons partly for that purpose. The obstructions now in these rivers, and the eagerness with which the salmon are hunted and caught, as soon as they appear in the spring, prevent the most of them from getting up to the ancient spawning waters. They probably do it early in the fall or late in the summer. I have seen them caught in the upper Penobscot late in August, but those I examined had no spawn in them, although they were plump and vigorous.

All the salmon tribe, which includes the several species of trout, white fish, &c., seek gravelly and sandy shallows for the place of depositing their spawn.

Salmon, in the English waters, where they are more strictly protected by game laws, have been subject to more critical examination, and a few quotations from some of the close observers in that country will illustrate the general habits of this fish, though the time or season of their spawning may vary from those that inhabit our waters.

A writer in "Bell's Life in London," under the sporting head, says "as soon as they (the salmon) have paired—the females seeking the males, as it is said maids do of leap years—they choose a fit spawning locality, from which, if they can, they chase away all other fish. For some days they are engaged in this operation. This being done and the female ready to lay her mature ova, or eggs, they commence constructing what I call their nests."

Mr. Young, in his book of the salmon, and who has often watched them, gives the following account of the situation and construction of their nests and subsequent operations:

"The spawning bed," he says, "which may be called a continuation of nests, is never fashioned transversely or across the water current, but straight against it. The way the bed is formed has never heretofore been accurately described. Some have affirmed that the male fish is the sole architect; others that the female does all the work; others, again, that the tail is the only delving implement used, &c., &c. A salmon spawning bed is constructed thus: The fish having paired, chosen their spot for bed-making, they drop down stream a little, and then rushing back with velocity towards the spot selected, they dart their heads into the ground, burrowing their snouts into it. This burrowing action, assisted by the powers of the fins, is performed with great force, and the water's current aiding, the upper part or roof of the excavation is removed. The burrowing process is continued until a first nest is dug sufficiently capacious for a first deposition of the eggs. That done, she retires down stream, and the male instantly takes her place, and, pouring by emission a certain quantity of milt over the deposited ova, impregnates them. After this, the fish commence a second excavation, immediately above the first, and in a straight line with it. In making these excavations they relieve each other. When one fish grows tired, it drops down stream until it is refreshed, and then, with renovated powers, resumes its labors, relieving at the same time its partner. The partner acts in the same spirit, and so their labor progresses by alternate exertion. The second nest completed, the female enters it as she did the first, again depositing a portion of her eggs, and drops a little down stream. The male forthwith enters the excavation and impregnates the ova in it. The different nests are not all made on the same day, but on different days progressively.

The ova in the first nest are covered with gravel and sand dug from the second, being carried into it chiefly by the action of the current. The excavating process thus described is day by day continued, until the female has no more ova to deposit. The last deposition of them is covered in by the action of the fish and water, breaking down some of the gravel crust above and over the nest. Thus is formed a complete spawning bed—not at once, not by a single effort, but piecemeal, and at several intervals of greater or less duration, according to the age and size of the fish and quantity of ova to be deposited. The time occupied in deposition chiefly depends upon the size and fecundity of the female fish. The average time is from five to ten days."

Mr. Young adds that as soon as salmon have spawned they are called *"kelts"* or *"foul fish,"* and are totally out of condition and unfit for human food. They drop down into the pools below their spawning beds, and there remain until somewhat recovered from the exhausting process of procreation, and then proceed slowly seaward, recovering and increasing their strength as they go along, and eagerly taking the fly and other baits thrown to them.

It is also stated by different observers, that the salmon eggs hatch in the gravel in from 60 to 120 days, according to the greater or less temperature of the water. They have been hatched artificially in much less time by being kept in warmer water.

Well, say you, all this is very interesting and very well, but how am I to avail myself of the knowledge in the artificial or any other mode of propagating salmon? In answer, permit me to say that these facts tell you what the salmon requires for successful propagation. The nearer you can come to nature's requirements in the propagation of anything, the more successful you will be.

More details in regard to salmon and trout breeding will be given by and by. The salmon is the head and type of this family (Salmonidæ) of fishes. The same requirements, with few exceptions, are necessary for the various species of trouts, whether brook trout or lake trout, and also for the white fish, (Coregonus,) which inhabit some of the northern lakes of Maine, only their operations are on a smaller scale, and they do not leave fresh water at any time for a sea life as do the salmon. They all, however, leave the deep lakes and their summer haunts, and come up in autumn to the shallow pebbly and sandy head waters of the streams to deposit their spawn, and then retire into winter quarters.

Shad and Alewives.

Although there are several other migratory fishes besides the salmon which spend the winters in the sea and come up to fresh water in the spring or autumn to spawn, such as the smelt, the frost fish or "tomcod," eels, &c., the two above named, next to the salmon, are most valued and most sought and cured for economical purposes. They too, in early times, used to fill the rivers and smaller streams of Maine in countless numbers, affording almost inexhaustible stores of subsistence to the people and a large surplus for exportation to less favored countries. They too, like the salmon, have had to give way to the inexorable improvements of civilized life, and have been annihilated by dam and mill and the many obstructions which the white man has thrown in their pathway. They are more simple in their wants and modes of life than the salmon. Their visit to fresh waters seems to be for the mere purposes of selecting a safe place for their spawn, secluded from the many sea enemies that are constantly following and preying upon them. They used to come up in myriads in the spring months, filling the rivers and dividing off into the tributaries, and following up until they came into the lakes. In the shoal and warm waters of these near the shores, where they could find sandy bottoms, they would excavate shallow basins, deposit their eggs, and soon return again to the ocean. The young descend late in the summer or early autumn. On their way up they were plump and fat, full of life and vigor. On their way down they were lean and lank and not worth catching—a *"shotten herring"* being considered the poorest of all fish and a proverbial type of the meanest of all animal life.

The loss of these fish from the waters where they were once abundant, is a serious one to the community. I do not recommend the artificial propagation of the shad and alewife, but it may be safely urged, that by a little modification of the laws necessary for their preservation at certain seasons of the year, and proper provision and attention to fishways to enable them to find the proper summer haunts, they could be again turned up our rivers and streams, and made to fill our numerous lakes with their young, which would thus ensure an annual return of them, sufficient to keep up the supply for propagation, and afford at the same time a vast addition to the subsistence of the community by their surplus. They are not all gone. Every spring, shoals of them, though not in such vast multitudes as of old, range along our coast, and are led by their instincts to seek the fresh waters for the purposes of continuing their species.

Three years ago, in the month of May, in company with a friend, while passing by the lower lock of the Cumberland and Oxford Canal, in the city of Portland, our attention was drawn to a crowd of men standing by the side of the lock, several of whom had long-handled nets, with which they were fishing, or rather dipping out fish from the water. On coming up, we saw that they were catching alewives in great numbers. It appeared that these fish, in their peregrinations along the coast, had been attracted by the fresh water of the canal, and instinctively entered it in order, as they supposed, to follow up to its source, (Sebago Lake,) but were brought to a stand-still by the upper gate of the lock. The men engaged there then shut the lower gate, and commenced catching them. As soon as those of them that were confined in the lock were all caught, the men opened the lower gate again, and admitted a lot more of them, and thus a wholesale destruction of them went on. I supposed that some of them might possibly work their way up, when the several locks should be opened for the passage of boats, and thus Sebago made a breeding place for them, but on inquiry, am told that there are few or none seen there. Now it would be a very easy matter to stock that lake with young herrings (alewives) by proprietors of the canal forbidding any of them to be caught on certain days, and placing men along the route to let them through the gates into the lake. Indeed, it seems that by renting the privilege of fishing for them on certain days, some considerable revenue might accrue to the company, while the production of the fish would become again a benefit to the section of country through which the canal passes. The same system might be adopted on many streams by having fish-ways or fish-locks, to aid their ascent, with much benefit to the country and no detriment to the mill interests.

Artificial Propagation.

A few rules and details for the artificial propagation of fish will now be given. It has been stated in the commencement of these remarks when and by whom the process by which fish propagate naturally was discovered, and the practical use which had been made of this knowledge. The eggs of fishes are, as has been stated, impregnated, *after they are laid by the female, simply by the immediate diffusion of milt from the male among and throughout the water in which they are deposited.* A knowledge of this single fact has led to great results, by making it as easy a matter to raise or breed fish, having all the fixtures ready at hand, as it is to raise chickens. All you have to do, after having your ponds or reservoirs ready, is to obtain a male and female fish—trout for instance—at the proper season, when the eggs of the female and the milt of the male are mature, and then, first gently press the eggs from the female into a vessel of water, and immediately follow it by pressing the milt from the male into the same vessel. Dr. Garlic of Cincinnati, Ohio, who has published a very interesting little book on this subject, thus describes his first attempt at artificially spawning and impregnating the eggs of trout:

"On the 21st of November I captured a pair by means of a landing net, and placed them in a bucket of water, and being provided with an earthen vessel, I made my first attempt. I partially filled the earthen vessel with water, and taking the female in my left hand, and making gentle pressure on her abdomen with my right, the eggs were forced into the earthen vessel containing the water; the male was treated in precisely the same manner, forcing the spermatic fluid into the same vessel; the appearance of the eggs was almost instantly changed from their bright golden orange color to a pale transparent yellow; they were then placed in running water with the vessel containing them."

Here you have the whole "craft and mystery" of artificial impregnation and propagation of fishes—the corner stone of Aquæculture. Two things must be observed and followed. 1. Press gently, for if the eggs and milt are not mature, they will not pass out by gentle pressure, and severe pressure would be injurious. 2. Follow up the diffusion of milt with the eggs, for it has been proved that they soon spoil if this is delayed.

Francis, in his work before mentioned, gives a more detailed account of his mode of operating. He considers a flat shallow tin dish, such as is used for baking pies in, to be the best receptacle to catch spawn in. It should be about half filled with pure water. If the spawn renders the water turbid and thick, something is wrong, and possibly the fish is not mature. He recommends that, before operating, you should collect in tubs of water about you, the fish you intend to operate upon, and it should be your first care to see that you have a plentiful supply of male fish, as it is better to have more males than females, for, although a small portion of milt will fecundate the ova, yet it is desirable that *enough* should be discharged to permeate the water in the dish thoroughly. Indeed, when the water is stirred to mix the milt and ova properly, it should be of a cloudy milky whiteness.

Having then discharged the ova into the tin dish, and turned the female back into the water, you should take a male fish and press forth the milt on the water, moving the fish round about, as he does, so that the milt may cover as large a portion as possible. It will flow into the water in a thin milky stream. If one fish does not furnish enough, take another and add a portion of his milt, and when you have enough, lay the fish aside and gently stir the water and ova with the hand, until the whole be thoroughly mixed, and every egg may have received its due proportion.

The tray should be allowed to stand a few moments, that the charm may have time to work, and then pour off a portion of the discolored water and pour in, gently, a fresh supply of new water from the stream. Then pour off a portion of this water and add more fresh water, causing as little disturbance of the ova while doing so as possible. This process should be repeated two or three times, until the water in the tin dish is perfectly clear. When the water is quite clear, the whole may be poured into a small tin pail holding from half a gallon to a gallon of water, the pail being about one-third full of water. The lid of this can should be perforated to admit air. Place it where it will not be disturbed, and continue your operations with another pair of fishes, and when sufficient spawn has been collected for your purposes, pour all into the can, which should not be more than half or two-thirds full of water. You can then carry this spawn where you please, *provided no rude shaking of it takes place.* Such are Mr. F.'s directions.

You will see that in the directions given above the fish is held up above the water, but Mr. Glover, an experienced and skilful manipulator in this business, objects to this, and holds the fish differently. He directs you to operate in this way: Place the tin dish before you, take hold of the fish by the head *with the left hand*, as described above, hold it up tail downwards so as to allow the spawn to drop down towards the vent, then take hold of the fish with the right hand, just below the vent, so that the back shall be compressed by the fingers and palm of the hand, leaving the thumb free to manipulate the belly of the fish; slightly bend or crook the fish, in order that the spawn, which has dropped down towards the vent, may be kept back and not be allowed to fall away from it when placed in a horizontal position. Press the belly of the fish into the water to the bottom of the tin dish; the dish, by this means, greatly assists the grasp in holding the fish. Now rub the side of the thumb (the inside, not the ball,) against the belly of the fish, just above the vent, pressing out the ova gently. The ova in the neighborhood of the vent will flow out freely, and when it ceases, hold up the fish again, tail downward, to allow the rest of the ova to fall down to the neighborhood of the vent, and so continue the operation until all be pressed out. Sometimes, if the fish be large, it may be necessary for a second person to hold the tail to prevent the splashing about of water and ova.

How should the Eggs be used after Impregnation?

You have seen that it is no very difficult thing to procure eggs and impregnate them; the next question is, how to manage them successfully afterwards. It is one thing to lay eggs and quite another thing to hatch them, and still another thing to rear the young to maturity. The mere hatching is very simple. Francis says he would "undertake to hatch a hundred young salmon with the aid of a cheese plate and a tumbler of water." But as hatching involves the subsequent treatment of rearing, and as all animals, in the state of nature, always forelay for the support of their young before producing them, it is necessary, in order to succeed as well as they do, to follow their guide. Let nature guide, is a good rule in nearly all the departments of life. Follow out, therefore, as near as you can, the natural laws and requirements which the fish themselves practise in their native undisturbed condition. This tells you that the eggs of trout, and salmon, &c., should be exposed to running water, and not to stagnant or turbid and foul water. As has been previously urged upon you, study the natural laws of the fish you wish to propagate, and you have the key to the whole system, and all that remains for you to do is to apply the laws so discovered as well as you can in an artificial way.

In hatching the eggs that you have procured and impregnated as above directed, it is not necessary that you should place them in natural streams, though that would be better. You may hatch them in your own room, or shop, in earthen and wooden reservoirs, and feed and care for the young until large enough to transfer to your fish pond, provided you have running water or any other pure water in agreement with the natural requirements with the species you are breeding.

Your ingenuity will prompt you to get up such constructions as will meet your wants. Some use simple willow, or wicker baskets, in which the eggs are deposited with clean sand and gravel, over which a little stream of water, from an acqueduct, or some reservoir, flows steadily and gently. Some use wooden troughs, placed side by side, but one elevated a little higher than the one next to it, like stairs, and let the water run into the top one, from thence into the one next below, and so on through them all and out from the lowest one. Where you have a spring, or a stream suitable, you can make larger and more permanent fixtures, and on a larger scale. Dr. Garlic gives the following description of the plan that he and his partner, Dr. Ashley, adopted: "At the head of a spring we built, says he, a house eight feet in width by twelve in length. We placed a tank, made of two-inch plank, four feet wide by eight feet in length, and two feet deep, in the end of the building nearest the bank. The water from the spring enters the tank through a hole near the top, and escapes through a similar hole at the other end, from which it is received into a *series of ten boxes.* These last boxes are eighteen inches long, eight inches wide, and six inches deep, and are so arranged that the first is much higher in the series than the last one. They must be filled with clean sand and gravel to the depth of two inches, the sand being placed at the bottom. The impregnated eggs are to be scattered over and among the gravel, care being taken not to have them in piles or masses." It is well to have the lower end of the boxes grated with wire cloth to prevent the young fish, when they are hatched, from "*skedadling*" and leaving you.

So much for the apparatus, or fixtures, or in other words the *nests* in which to hatch your finny chickens. If those described don't suit you, or meet the peculiarities of your location, as was before observed, your wits will soon suggest such variations as will answer your purposes.

Having your nests all made, and the eggs all suitably deposited, the incubation process has begun. Your next care is to keep them clean and allow no sediment or mud to accumulate over them. Examine them frequently and see that all goes on right, and if any of the eggs turn white, they are addled ones, and will never hatch, and should be picked out with a wire forceps, a spoon, skimmer, or some other suitable instrument, and thrown away. It is said there is a species of moss, called "*byssus*" by botanists, that sometimes grows upon the eggs and destroys them. This must be owing to their being in impure water or sand. When this takes place, you should remove all the eggs, throwing away the mossy ones, and clean out the nests, and supply clean new sand and gravel and better water.

It takes trout's eggs about 60 days to hatch in water kept at about 42 degrees. In colder water it will take longer; in our natural streams in Maine it takes twice that length of time, say 120 days or four months and perhaps longer.

How to Treat the Young Fish.

Your fishes being now hatched, how shall you manage them? You will find when the young fish is hatched that he has a comparatively large sac or bladder-like bag attached beneath his body, which he carries about with him for some time, it growing gradually smaller and smaller until it disappears. This bag is a part and parcel of the egg, and contains a source of nourishment for the young fry until it becomes absorbed and assimilated to its body. During this period, which lasts nearly or quite a month, they will need no feeding, but they will require care and protection. Boxes or tanks, or any kind of reservoir holding a barrel or two of water, which should run gently through it, will hold a thousand of them. The orifice where the water passes out should be covered with wire cloth to prevent their escaping. When the bag has nearly disappeared from beneath their bodies, you may begin to feed them. Lean beef, or mutton, or other animal flesh, may be boiled and crumbled or hashed up very fine and given them. Worms and maggots may be given them, but not too profusely at first. Fresh fish may also be cooked and fed out to them in the same way. When about two months old, shift them into larger quarters, or, if you have a pool, or small pond of water, they may be placed in it, provided there are no larger fish there to gobble them up. Some recommend to keep them in tanks until they are a year old, before placing them into ponds, but this is too much trouble, if you have suitable ponds for them. In aquæculture of this kind, you will need separate ponds for the young and old, as much as you do in agriculture for your calves and older cattle. This is conformable to nature, for if you observe carefully, you will always find the young fry in the shallow pools and margins of lakes and streams, where the larger fish cannot very readily get at them.

After they are about a year old, fish get to be pretty voracious, and will eat a great variety of food, and should be fed accordingly, if you want they should grow fast and be fat and sweet. Trouts, in a state of nature, will eat water insects and small shell fish which they find attached to aquatic plants, and will catch flies and other insects on the surface. They will also eat dead animal offal, worms, maggots, bread, and almost every thing you may give them. You can thus "stall feed" them as well as you can an ox or a sheep, and the profit will be comparatively greater, because they will eat food of but little worth fed out in any other way.

Application of these Principles to Salmon Raising.

It has been stated in the course of these remarks, that salmon are a migratory fish, changing, like the wild geese, their climate and their feeding ground twice in a year; that in spring and summer they seek the fresh waters, and that in winter they live in salt water; that they breed in the "shallows" of rivers, in nests that they form in the ground; that the female deposits her ova in them, and that immediately afterwards the male impregnates the ova by shedding his milt upon them; that the ova are hatched on an average in 120 days; that the young so produced do not assume the fish form until a month old; that it is then a salmon fry, sometimes called in England a "*parr*;" that it continues in fresh water in this state one year, and them becomes covered with scales, and is called a "*smolt*," is about five or six inches long, "with a silvery coat of two or three ounces in weight; that it then migrates to salt water, feeds there three or four months, grows rapidly, and comes back a '*grilse*' or young salmon, sometimes weighing eight pounds;" that it then spawns as did its parents in the shallows, and then again seeks the salt water; that in three or four months it returns, still more increased in size, becoming "a mature salmon of seventeen or more pounds." And this is the routine of salmon life, migrating and immigrating from lake to ocean and from ocean to lake every year, if not taken or molested any way. But it has been seriously molested in our rivers, shut out from its natural haunts and breeding grounds, and continually pursued and destroyed whenever it shows itself in fresh water, caught by spears and hooks and nets and wiers and in every conceivable way that ingenuity could devise to destroy it utterly from our waters. There are but two ways to restore them, viz.: first, by having suitable fish ways and the command of the waters for the time being, to ensure their safe transit and safe existence during the spawning; and second, by preparation of artificial ponds for them to hatch in and grow for one year, preparatory to their migration to the sea. And how is the best way to do this? It has been done successfully in other countries, and perhaps the account that Mr. Young gives of his experiments by the side of the river Shin, in Great Britain, which he had conducted for three years at the time he made them public, will be as good a guide for you as can at present be given. It supposes that you are so situated as to have the control of a little land by the side of a river that salmon would have access to from the sea, if they had a chance; and there are many such rivers in Maine. "To give the seed (salmon eggs) the same advantages as those would have which naturally spawned in rivers, the artificial breeding ponds should be constructed in the immediate vicinity of, or in *the* river, and the pond should be fed by a small stream, or 'lead,' taken from the river, so that the *temperature* and all the conditions of the one may in every respect agree with those of the other. At the spot where you propose to take the 'lead' from the river, you commence the erection of a wall to shut out the main current. The wall may be built in the river by the side of its banks, and its height there is to be greater than the highest flood marks of the river. In the bottom of the wall, where it takes the 'lead' from the river, an opening or *drain mouth* is to be constructed of the width of the current you wish to flow your ponds inside the defending wall. This opening at the upper end of the wall is to be so framed that, whether the state of the river is low or high, the supply of water to the pond will be neither injuriously diminished nor increased.

The *drain mouth*, or opening in the wall, is to be secured by a strong iron grating, the bars of which are to be half an inch apart. This grating will prevent the accumulation in the pond of any thing hurtful to them. The bed of the pond must be dug to the depth of five feet, and they must be nine or ten feet in width, or about eighteen or twenty in length. Their bottoms must be lower by five feet than that of their feeder. The bottom must not be quite flat, but graduated, rising from the end furthest from the head of the current, toward the opening of the *drain mouth*.

The necessary inclination can be given to the bottom of the pond by beginning with a layer of gravel one foot thick at the farthest end, and finishing off toward the mouth with a layer of gravel eighteen inches thick. The bottom of the pond will thus become an inclined plane.

The ova are to be deposited at the top of the gradient where you have finished off with a layer of eighteen inches of gravel, in order that they may have the benefit of sharply running water.

The lower part of the inclined plane, or the deepest part of the pond, suits best the fry after incubation. The walls that are to secure the pond may be stongly built of rough stone, but no lime must be used in the walls or any thing connected with the pond. To secure the pond from the entrance of the smallest fish, besides the iron grating already mentioned, there must be another of copper wire cloth, so fine as to prevent the possibility of the smallest trout passing through the interstices.

If a diminutive trout should enter, it would devour the fry as soon as they are hatched. Each end of the pond should be secured in the same way. At the end where the water runs out there should be, if possible, a fall in the river which would effectually prevent the ascension of any predatory fish. Some persons have tried artificial breeding (of salmon) in ponds supplied with water from springs and hill-burns, but in such trials no sensible person ought to expect satisfactory results, or, at any rate, results similar to those that would be derived from the use of ponds constructed in salmon rivers, or fed by water emanating directly from them.

Both the development of the fish *in the egg* and *from the egg* depends upon the temperature of the water, and we know that a single frosty night will reduce, by many degrees, the temperature of rills and rivulets. Fry, therefore, hatched in ponds fed by these hill streams must be stinted in growth—kept at a *stand still* during many weeks—and they can never arrive at the *smolt* state in the same period of time as fry bred in the waters of rivers. These latter fry are in their natural element—natural as to temperature, and in the food, insects, &c., it produces.

On the contrary, fry bred in ponds fed by springs are, as it were, subjected to a different climate, strange and unnatural to them, barren or nearly so, of insects, and foreign to their innate tastes. Their progress in growth, therefore, cannot equal that of the fry bred in favorable localities.

When the ponds are perfectly formed and constructed, they should be filled with water, and it should be allowed to run freely into and out of them for a few days previously to depositing the spawn in them. This is necessary in order that the newly laid gravel may be washed well, the beds properly seasoned, and all mud or alluvial matter got rid of. The artificial spawning beds must be reduced as nearly as can be to the condition of the naturally formed ones of rivers.

The next step to be taken is toward procuring proper spawn for depositing in the ponds. To do so we must watch carefully some natural spawning grounds of the river,—or some river at the time when operations of spawning are going on,—and we must capture a pair of salmon that have actually commenced the spawning process. If we do not, we cannot be sure of procuring spawn in the ripe state. We must avoid capturing, at random, any pair of fish we may see on the spawning bed, because many consorted males and females are seen hovering about the spawning bed several days before they begin depositing their spawn. If from such fish ova are expressed by manipulation, they will be found in an immature state, their pores not yet open for the reception or absorption of the milt, and expressing it over them will not produce impregnation. On the contrary, when a pair that have commenced spawning are captured, their ova and milt will be found in the matured state required, or at least a portion of them. The spawn may be then pressed out into vessels and impregnated by the processes already given.

And Mr. Young says, I would solicit the attention of the owners of rivers to the following great fact:—Salmon spawn, artificially expressed from parent fish, and treated in the manner directed, may be conveyed without injury very long distances—from rivers in one country to rivers in another.

The pond being ready for the reception of the spawn may now receive it. It must be imbedded at the head of the pond—at the commencement of the inclination of its bottom, in a small trench about five inches in depth, formed longitudinally with the current, and not across it. The spawn must not be laid all of a heap in the trench, but carefully mixed with gravel all over its bottom, and then covered in with the gravel that has been excavated in forming the breeding furrow. The trench and its covering must lie on the slightly inclined plane principle. The gravel with which the trench is covered in must not be pressed down, except very slightly, in order to prevent the free percolation of the water, which must have full ingress and egress to and from the spot where the seed lies deposited. The action and constant moving of water are essentially necessary to perfect this strange incubating process. Without them ova will be non-productive, for placed in gravel at the bottom of still, or slugglishly running water, they will putrify, or, to use a generally known expression, they will be "*addled.*"

Thus you have the benefits of Mr. Young's experience. You perceive that his method requires no complicated machinery—no spawning dishes or utensils or breeding boxes He made his beds in the soil of an old mill-race in the river Shin, and took his spawn from that river. The temperature of his spawning beds and of the river was the same, and his artificially bred salmon assumed the silvery migratory smolt coat at the end of twelve months." What man has done, man can do again, and the experiments so successfully accomplished by Mr. Young in the river Shin can be made in most of the rivers of Maine."

Perhaps the inevitable question of Yankee foresight and prudence will arise here and ask—"Will it pay?" A few facts may be useful by way of answer.

A few years ago, experiments were instituted on a large scale at Stormontfield, near Perth, in Scotland, upon the propagation of salmon. Three hundred thousand (300,000) eggs were placed in the hatching boxes in the months of November and December. They hatched out in April and May following, and in June they were placed in a pond prepared for them, where they were fed and protected for a year. They had then become *"smolts,"* and were large enough to be let out into the river and go down, according to their natural instincts, to the salt water. A large number of them were marked, previously to being let out, by cutting off the fleshy (adipose) fin that grows between the dorsal fin and the tail. The largest of them weighed at that time but about two ounces, and measured from five to seven inches in length. They were gone to the sea about two months, and in August many of them returned, and such of the marked ones as could be were caught, weighed and measured. The increase in size was prodigious. The smallest one weighed 3½ pounds and the largest one 9½ pounds, and the others were of different weights intermediate between these figures. The nine-pounders measured 2½ feet in length. It was estimated that about 200,000 of those hatched were turned out to sea.

Now let us make a little calculation on the returns and see if it will pay. As salmon, from the egg state to maturity, are the prey of almost everything, we will suppose that only half of the 200,000 returned the past year, and that these weighed on an average six pounds. This would make an increase of veritable, substantial salmon in two years and a half from the egg, say 600,000 pounds of salmon, and this we will say is worth only 10 cents per pound. This would figure up to sixty thousand dollars worth, ($60,000). Is not this a pretty fair per centage of profit on the investment? If this should be thought to be too large, take the data and make such deductions and allowances you please, and satisfy yourself whether it would pay.*

Perhaps you will object because I have given you experiments of foreigners altogether. I would gladly have given those of home origin if I could have found them, but, with one exception, I know of none. This exception is the experiment of the Messrs. Treat of Eastport, who commenced, a few years ago, the work of assisting the salmon to breed in certain waters they had the control of (for a certain time) in their own natural way. We are informed that the experiment went on well and encouragingly until stopped by a proprietor of the water above them, who made a demonstration of his "vested rights" by putting a dam across the river, thus shutting them out, and *damm*-ing the experiment as well as the water.

Propagation of Trout.

The trout is a favorite fish the world over. Every body loves the trout, both for the keen sport it gives to the angler, and for the rich, delicate and nutritious treat it affords for the table. Handsome in form, beautiful in spot and color, wary but bold and active in his movements, he has always been the choice spirit that challenges the admiration as well as skill of all lovers of good old Izaak's "gentle art," whether he be schoolboy or man.

The trout is found too in a greater variety of locations than any other fish. Wherever he is, however, you find pure and living water—none of your stagnant pools or dead seas hold him. In the clear and silvery lakes of our forests and woodlands, in meadow brook and mountain tarn, in our broad rivers in the very spot so accurately and poetically described by Thompson—

> "Just in the dubious point, where with the pool
> Is mixed the trembling stream, or where it boils
> Around the stone, or from the hollow'd bank
> Reverted, plays in undulating flow,"

you will find him in the warm season of the year. In late autumn, you will find him with his chary spouse crowding up to the sources of our streams to deposit their spawn in the sandy and gravelly beds, to be hatched in the coming spring. In midwinter, you will find him in a "state of retiracy," down in the deep waters of the lakes, far out of the way of frost and snows, ready to take any bait you please to send down to lure him to his destruction. "Take him all in all," he is a "smart enterprising" fish, and, like the "universal Yankee nation," is found wherever he can get a living, and a living he is bound to have, even if, like this same prototype, he gobbles up a weaker neighbor or two for his own special benefit. I once caught *three* trouts at one pull on a single small hook. One was large, and inside of him was a medium sized one, and inside of that a small one. They afforded a practical illustration of the proverb sometimes *whispered*, no doubt *unjustly*, in commercial circles, that "the great fish eat up the little ones."

---

* In 1846 there were taken by the net alone, on the Tay and Earn, below the mouth of the Islay, upwards of 84,000 salmon and 80,000 "grilse" (yearling salmon.) Allowing the average weight to be 10 pounds, you have 640,000 pounds, which at only 10 cents per pound would amount to sixty-four thousand dollars, ($64,000.)

With all the other good qualities of the trout, they are the easiest and most satisfactory fish for artificial domestic propagation. Though naturally shy and wild, they are very easily tamed and rendered so docile, that they will come fearlessly at call, and take food from your hands. They will remain healthy and contented in artificial ponds, provided you furnish them with pure water and suitable food.

Trouts, with mature spawn, can be easily taken with nets in October and November, at the head waters and shallows of our spring brooks. The process of extruding and hatching the eggs, has already been given. Nothing further need be said, therefore, except a few hints on the construction of ponds for their accommodation. Whether your pond be a division of a natural stream, or made by leading spring waters into an excavation dug for the purpose, it will be most convenient to have at least three of them connected together. The upper one may be the smallest and shoalest, to receive the young fry as soon as the umbilical vesicle has been absorbed, and they will do to put in. The second may be larger and deeper, into which they should be introduced when a year old, to make room for another brood of young fry ; and the third should be largest and deepest of all, to receive those that are two years old and in which to be fed and fattened, and from which they can be taken, whenever you feel disposed to treat your aquæcultural skill and labors by luxuriating upon the fat of the fish pond. Between this lower one, and the next above, should be a race way, or space with gravelly bottom, into which they may pass up in the fall, to indulge their natural instincts in the spawning season. It will be a good plan to introduce into some part of it such aquatic plants as pond lillies, pickerel weed, &c., as these afford a harbor for many aquatic insects which trouts love. Frogs, in the spring of the year, should be introduced where they can spawn, as trouts are very fond of their eggs and the young tadpoles.

Transferring fish to different waters.

The transferring of fish from their native waters to those not inhabited by them, is a branch of Aquæculture that has sometimes been practised with good results.

I was, many years ago, told by some of the old settlers on the Kennebec, that there were no pickerel ever seen in the tributaries on the west side of that river, in the vicinity of Augusta, until they were transferred there from Togus lake, which is on the east side, by the late Robert H. Gardiner. They were put into the Cobbossecontee stream above the mills in Gardiner. The few put in at that time have multiplied and spread into all the connecting waters, and are now, with the exception of the perch, the most abundant of any species of fish found there.

There are several modes of transferring fish for the purpose of supplying waters deficient of them. One very good method is by the means of the impregnated ova of the kinds you wish to obtain. These may be safely and successfully carried almost any distance of a few weeks travel, by being properly packed in moistened sand, or in wet cloths or sponges, &c., &c., and then hatched, and placed in the water where it is desired the fish should be.

It is said by some, though I have never seen it done, that fish, caught in the winter, and immediately covered in snow, become torpid, and may be kept so a long time, and when placed in water, recover from their suspended animation, and suffer no ill consequences by the operation.

A very excellent mode of transferring fish, was adopted by Drs. Garlic and Ashley, by keeping them during the passage in ice water. This kept them in a partially torpid state and they remained very quiet while on the way. "The transportation of live fish," he remarks, "has always been a laborious business to me, and hazardous to the fish, until I hit upon the plan of conveying them in water made very cold by the addition of ice. I carried four hundred and twenty trouts a distance of twenty-eight miles, without changing the water once, in a barrel only three-fourths full of water. The water was kept as cold as it possibly could be by the frequent additions of ice. I lost only four or five of the fish, and these were killed by being jammed between the pieces of ice. They were in the barrel fully eighteen hours without the water having been once changed. I feel very confident they would not have lived a single hour in the water, had it not been for the extreme cold caused by the frequent additions of ice. The fish, however, were all small,—one-third of them, perhaps, were two years old; the remainder were yearlings and young fry of six months."

There are several species of fish found in other sections of the United States, but not now found in our waters, that would be quite an acquisition if transported hither. I will name but one, however, now, and that is the Black Bass, (*Centrarchus Fasciatus* of DeKay, *Grystes nigricans* of Agassiz.) This fish is found in the rivers and small lakes in the western part of New York, and has been introduced from them into some of the ponds (lakes) in or near Plymouth, Mass. It might be obtained from them without much trouble and introduced into some of our own waters. It grows to good size, say from twelve to eighteen inches in length; takes the bait or fly readily, and affords exciting sport to the fisherman and richly rewards his skill with an excellent repast for his table. It breeds in April and May, and is recommended as being a superior fish for artificial ponds.

There is also a capital fish found in the Fish river lakes in the north part of Aroostook county, and some other lakes in the northern parts of Maine, but not known in those of the interior, or seaboard. It is the White Fish, (*Coregonus albus.*) It belongs to the salmon or trout family, (*Salmonidae,*) lives in the deep waters during summer but comes up with the trout in autumn to the head waters and shallows to spawn. There is no doubt that it will live where the trout will, especially the lake trout, or "togue," and it would be a valuable acquisition to fishing grounds in any part of the State where they are not now found. Would it not be well also to try a transfer of the delicate "Blue black trout," (*Salmo Argwas-suc* of Girard,) found now only in the Rangely lakes, to some of the lakes near the seaboard?

There is one precaution to be observed in this transferring fish from one locality to another. You should be sure that their new home is well furnished with food natural for them.

Hybridizing or Cross-breeding of Fishes.

There can be no doubt that fishes may be hybridized, and new breeds made by crossing different species with each other. This would be, if not profitable, at any rate a curious and interesting operation, and afford opportunity to the naturalist to observe some of the laws of the physiology of this class of animals in respect to the laws of their propagation.

That different species of the same genus have, in some instances, "crossed the breed," as it is called, is proved by several authentic cases. The following is one of them. It was related to me by my friend J. F. Anderson, Esq., of South Windham, in this State. It refers to some crosses between the gold fish and different species of the *Cyprinidæ* family. "Regarding the cross between the gold fish and the chub, there can," he says, "be no doubt, for I repeatedly observed such results in the little pond at the foot of my garden, in which a lot of gold fish were introduced to a lot of chubs which had been its previous occupants. They bred there for several years, but one spring the bank (or wier, for, as you remember, it was an artificial pond,) gave way, and they all went into the Presumpscot river. During that, or the next season, Daniel Dole, Esq., an observing man, living near Cobbywright brook, one of the tributaries of the Presumpscot river, brought for me to examine, 'a very queer fish found in Cobbywright.' I at once recognized one of the speckled and splashed, red and white fish bred in my pond."

The ease with which the ova of fishes can be impregnated by artificial means, as has been before described, makes it also a very convenient, and probably a very efficient method of getting up cross breeds. It will also be the true method of ascertaining how far the eggs of one species can be impregnated by the milt of another species, and vice versa. It may be doubtful how far you would succeed in crossing the species of different genera, such as the pickerel and trout for instance. If there is nothing incompatible between them, and the milt of one will fecundate the ova of the other, there would be trouble in obtaining individuals of both species in full maturity at the same time of the year. The pickerel spawns in the spring, and its eggs hatch in about three weeks, while the trout spawns late in autumn, and its eggs are much longer in hatching. If by any means the pickerel could be delayed in the maturing of its eggs, and the trout matured earlier, the experiment might be fairly tried. This idea is thrown out merely to illustrate some of the difficulties in the way of such experiments, and not with any expectations that any particular benefit would arise from such a cross. A trial, however, might easily be made between species of different genera that mature at the same season of the year, as the pickerel and the white perch, or the yellow perch and white perch, or any others that are in season together.

Again, the salmon and the trout might be tried together, and if the hybridizing would produce a cross that, while it partook in its characteristics as to size and good qualities of the salmon, without its propensity to migrate to the sea, but remain in fresh water all the time, it might prove quite an acquisition.

Some have thought that the salmon trout, which is caught in some of the Maine lakes, (*Salmo Sebago*, Girard,) is or was originally a cross of the salmon and common trout. Whatever may be the facts in this case, one thing is certain—a very good and excellent fish, whether for sportsman or epicure, is that same salmon trout, and is deserving more attention, protection and culture than has hitherto been bestowed upon it.

Conclusion.

My sole object in preparing this compilation of observations, experiments and facts upon Aquæculture, and recommending special attention to it Maine, is to invite an investigation of this great subject by the people—a subject so full of hopeful results and promise of producing, if successfully carried out, an almost unlimited supply of healthy subsistence to our population, and that too from sources now lying neglected and dormant.

You will admit that it would be a crying evil, and a crime, if the now fertile acres that yield so freely to the hand of agriculture, the rewards to its industry, should be allowed to become neglected and thereby fail to give their yearly supply of food and comfort to man. Is it less so in our having suffered our lakes and rivers and smaller streams, that once teemed with an annual overflow of animal life, full of grateful and generous sustenance to the community, to become almost fishless and barren?

The plea of ignorance of the science and practice required for restoring them to usefulness again, may be urged with much truth and reason by way of excuse for not doing it; but, hereafter, it may be hoped that the diffusion of knowledge in regard to the experiments and researches made and making in this department of industry will soon dispel this ignorance, and that the true principles of Aquæculture, in all its bearings, both maritime and inland, will take their stand in rank and importance with those of Agriculture, and both be considered as equally of vital necessity to the strength and prosperity of the State. That, guided by these principles, the productive powers of our whole domain, of ocean and lake and land, will soon receive the attention and culture they deserve, and our people be able to gather full harvests of rich subsistence from our waters and "suck an abundance from the sands of the sea."

FRUIT CULTURE.

My report last year contained a paper relative to the culture of the Apple and the Pear—the most valuable fruits of temperate climes. It is proposed to continue the same general subject by submitting some remarks relative to other fruits, several of which, although demanding less extensive cultivation, are yet equally worthy of a place in every well appointed fruit garden.

THE PLUM.

The plum is a valuable fruit both for the dessert and for domestic cookery, especially for preserves. In most of the desirable varieties it is hardy enough for our climate, and in some locations it succeeds well, but oftener its culture is very precarious and uncertain, and chiefly from two causes: first, the liability of the fruit to be stung by the curculio, and next, the liability of the tree to the disease called Black Knot. These are so serious obstacles that by many its culture has been abandoned. Where it has succeeded, the fruit produced in Maine has fully equalled if not surpassed the productions of any other State in the Union.

The plum thrives best in a rather moist, rich place, where there is a sufficient depth of soil, and of a clayey or loamy character, rather than sandy or gravelly. It is somewhat of a domestic tree, that is, it usually thrives best about buildings, and especially if planted near accumulations of chip-dirt, soap suds and the like. If such situations are well sheltered, all the better. In propagation, budding is preferable to grafting, although the latter will succeed if performed quite early in spring, say in March or April. The common Canada plum, often erroneously called pomegranate, makes a good stock to work the plum on if budded when not more than two or three years from the seed and very near the ground. The common horse plum makes a good stock also, but damsons and suckers of all kinds are to be avoided.

The only remedy for the ravages of the curculio which has been found to be of much avail is by shaking the trees and killing the beetles. As soon as it commences to puncture the fruit place some sheets under the tree and jar it smartly several times. This is best done by sawing off a lower limb leaving two or three inches next the trunk. Strike this with a wooden mallet, when the insects will be dislodged and fall upon the sheets, when they should be killed at once. If this practice be followed up fairly for a week or two the crop may usually be saved.

With regard to the cause or remedy of the disease known as the Black Knot but little is certainly known. Many suppose it to be caused by the puncture of an insect, and grubs of the curculio and sometimes of other insects are found in the knots upon their being cut open, but these are more probably a sequence of the disease than the cause of it. There is a strong probability that the disease is a constitutional one, and that it affects the whole circulation, for we find when the attack is malignant that if the knots be wholly removed manifestations of the disease presently appear in other places. In cases of mild attack the complete removal of all the diseased portions—amputating limbs when necessary—proves a successful and sufficient remedy; and this should be practised in all cases until found ineffectual, in which event the tree should be cut down and burnt. Washes of various kinds have been used to apply to the surfaces from which the knots have been removed. Solution of common salt, of chloride of lime, of copperas, and of other salts, also spirits of turpentine and the like, but I have found no advantage from their use beyond what has followed *clean* cutting. The entire and complete removal of the affected part is of most importance. Often for a term of years the disease does not appear at all, and anon it breaks out with much virulence. Such attacks usually follow a winter of unusual severity, or a season of excessive produtiveness, producing debility.

Varieties.

The **GREEN GAGE** is universally considered to be the standard of excellence, having never been surpassed in quality. It is of medium size, rather flattened, and the tree is less vigorous and productive than some others.

IMPERIAL GAGE. This is quite large, oblong, greenish yellow, with faint stripes under the skin, of fine quality. The tree is of vigorous upright growth and productive. One of the best for general culture. It often passes under the name of Green Gage.

WASHINGTON. Of the largest size, yellow, very handsome and of fine quality. The tree is very thrifty and in most situations, sufficiently productive. A general favorite.

JEFFERSON. This is a fruit of the first quality. Large, oval, yellow with a purplish red cheek, very rich, juicy and luscious.

MCLAUGHLIN. A native of Bangor, in this State, and originated by James McLaughlin. Probably a seedling of Green Gage, which it equals in quality and somewhat resembles in form, although much larger and deeper colored. Exceedingly rich, juicy and sweet, rather early and good bearer.

COE'S GOLDEN DROP. Very large, oval, beautiful and excellent. Valuable for coming after other fine plums are gone. Requires a warm situation to enable it to ripen fully—October.

Other plums which in many gardens have given a high degree of satisfaction are the *Drap d' Or*, (very early,) *Smith's Orleans*, *Lombard*, *Purple Favorite*, *Columbia*, *Yellow Gage*, *Bleeker's Gage*, *Lawrence*.

I examined the fruit of a seedling originated by Col. Henry Little of Bangor, well known for his zeal and success in the advancement of horticulture in Maine, which bore the past season for the first time, and which gave promise of fully equalling any plum yet known to cultivators. As the first fruit of seedlings is rarely equal to what they bear in subsequent years it will be watched with much interest.

THE CHERRY.

The Kentish cherry, common throughout New England and generally called *tame*, to distinguish it from the sorts which grow wild among our forest trees, was formerly very plenty through the State. It proved hardy and bore abundantly. But of late years the stock has become diseased, from some cause, and having been usually propagated by suckers which carried the tendency to disease with them, it is now grown with less success than formerly, and in some sections has become extinct. They were acid and of only tolerable quality. The Duke and Morello cherries are next in hardiness to the Kentish and are hardy enough to succeed in all situations where the conditions are not very unfavorable. Of these the *May Duke* is perhaps the best—and most of them are greatly preferable to the Kentish. What are known as the Heart and Bigarreau cherries furnish the finest fruit of all, but the success attending their culture will warrant the expectation of satisfactory results only in warm dry soils, underlaid by a dry subsoil and in favorable situations as regards aspect and shelter. Under such conditions the Heart cherries form vigorous, rapid growing, luxuriant, branching trees, desirable for shade and ornament as well as for their excellent fruit. For standard trees they should be budded upon seedlings of the Mazzard cherry and the season for budding is rather earlier than for apples or pears. For dwarf trees the Mahaleb or Perfumed cherry is used. Upon this stock they grow for a few years with nearly as much vigor as upon the Mazzard, but this vigor is checked after a while and the trees then devote their strength to the formation of blossom buds and fruit, more than to the production of wood. The common small red wild cherry sometimes called pidgeon cherry, which produces its fruit in umbel-like clusters similar to those of the cultivated cherry I have found to succeed as a stock to bud the better sorts upon. The seedlings should be worked at one or two years of age, from the seed, and near the ground; if grafted into limbs the scion greatly overgrows the stock, and the trees are short lived. The wild black cherry, choke cherry, or any sorts which produce their flowers and fruit upon *racemes*, like strings of currants are wholly unfit to use for stocks. I have never known buds or scions to succeed upon these, even temporarily.

Varieties. Among the best of the Duke cherries are the May Duke, Reine Hortense, Belle Magnifique and Belle de Choisy. Of the Heart and Bigarreau varieties the Black Eagle, Coe's Transparent, Elton, Napoleon and White Bigarreau or Yellow Spanish have given the best satisfaction.

GRAPES.

Maine is no exception to the remark that the grape vine is indigenous to all parts of New England, although more plentiful in some parts of the State than in others. When Wood Island, near the mouth of the Saco River, was discovered, it was so abundantly stocked with vines as to receive the name of Isle of Bacchus. Wild vines, in various sections, are found growing freely in valleys or on hill sides, climbing high trees or rambling over rocks and bushes, some of them ripening their fruit (such as it is) in any season, some of too late maturity to be of any value even were were the fruit of such quality as to render them desirable, which is rarely if ever the case. It is true that the State lies north of what is usually considered the grape-growing section of the Union, and only the earlier ripening varieties will arrive at full maturity.

For many years the culture of the grape has received some attention, but the earlier attempts were invariably made either with varieties of the foreign vine, like the Sweetwater or Black Cluster, &c., or with native sorts better suited to a more southern latitude, like the Isabella and Catawba. The shortness of our seasons, the severity of the winters and the vicissitudes of cold and heat, moisture and drought, prevent much success with such kinds. The Isabella has been more grown than any other, but it is too late in ripening to succeed except in rare cases and in exceptional seasons. It not unfrequently colors tolerably well and is often supposed to be ripe, but I have never seen it attain the quality which it does five degrees or more farther south.

Within a few years quite a number of kinds have been introduced of earlier maturity by several weeks, and some of these have been successfully grown and ripened, as we have reason to believe, in nearly all parts of the State. We have seen them as far north as twenty miles north of Farmington, thirty miles north of Bangor, and as far east as Calais. It is believed that with these, and still more so with others yet to be brought to notice, for every year scores or hundreds of new seedlings are being introduced to cultivation, some of which will undoubtedly excel any yet produced both in quality of fruit and earliness of ripening, every farmer and every citizen with only a few rods of land may have an abundance of this most estimable fruit for his table, or for the manufacture of a domestic wine which shall displace the adulterated wines of foreign production, and the miserable, drugged imitations made here, now sold under the name of wines among us.

To attain this desirable result it is absolutely necessary to confine our efforts to varieties of native origin and of the earliest maturity, and to bestow suitable culture. Such a result is worthy of strenuous and continued exertions.

In all ages the grape has been used as the emblem of plenty and felicity. As such it is frequently mentioned in the Bible. To sit under one's own vine and pluck its luscious fruit in security has been deemed the height of outward human felicity.

The grape is an eminently healthful fruit, and its curative properties in disease are so well understood in some countries that the "grape cure" is more familiarly known and resorted to than was ever the "water cure" among us.

The *Vitis Vinefera*, the species indigenous to the eastern continent, and imported hither from thence, as before remarked was early introduced, but except under glass, where the vicissitudes of climate and the liability to mildew are greatly under control, little success has attended the culture of any of its varities. In the vicinity of Augusta, and in a few other places, it seems to be comparatively free from liability to mildew, and the Sweet Water and Black Cluster sometimes ripen fair crops, but they cannot be recommended for general culture.

In the *Vitis Labrusca*, one of the species indigenous to the western continent, we have a very different plant and one perfectly adapted to our climate. Its foliage is thicker, more downy, especially upon its under surface, and so less liable to scorch beneath the rays of a hot sun. Its growth is far more robust and vigorous, its wood longer jointed, its habit greatly hardier. The fruit varies very much in size, color, flavor and time of ripening. As found growing wild it is rarely fit to eat, the skin being thick in most wild varieties, the pulp tough, and of foxy, disagreeable flavor. But there is abundant proof that it is capable of great amelioration, not by mere cultivation of the wild vines, which does no good, *but by the variation induced in successive generations of seedlings*, through cultivation. In this way it will undoubtedly become the parent of varieties as much better than the wild fruit as the Baldwin, or Greening, or the melting Beurres and Doyennes are better than the wild crab apple and pear from which they sprang.

The obtaining of grapes combining in a sufficient degree all desirable characteristics, both of vine and fruit, is a work already well begun, but by no means completed. Contributions to it should be made by every cultivator as opportunity may serve. Mr. Bull, whose success in raising the Concord is so well known, has related his experience in this matter, which is so instructive that we copy it for the benefit of any who may desire to grow seedlings:

"The raising of new varieties of grapes from the seeds of the best natives, is probably the most direct way to obtain such kinds as will be best adapted to our climate, good enough to satisfy our taste, prolific and profitable for the market. This will be a work of time, but it is fairly begun and must succeed.

Perhaps I cannot do a better service in this connection than to state my own experience in this branch of horticulture. Having pursued it for nearly twenty years, and finding my first opinions greatly modified in the course of that time, I may perhaps, save the beginner some time in his practice which he might otherwise lose for want of reliable data to commence upon.

I was led to commence the raising of grapes from seed, from the impossibility of ripening any of the grapes then in the lists of the nurserymen. Living in the valley of the Concord, with a season shortened at each end by the early and late frosts incident to such localities, loving grapes more than all other fruits, but not able to ripen them, I turned to our native stock and procured from all quarters native vines which had a local reputation for excellence, but found myself disappointed in all of them.

Believing that a good grape could be obtained out of this stock, and that if I attained success it would lead others to follow the same course, so that in time Massachusetts could have her own grapes, as she already had her Baldwins, her Porters, her Hubbardston, and other excellent seedling apples, I set about the matter; I wanted a grape to begin with, which should be a vigorous grower, prolific, early, hardy, and with these preliminaries, of as good quality as possible. I found a grape having these qualities—a pretty good eating grape for a native—and with this I began. In five or six years the seedling bore fruit; these seeds were planted again, and in the third generation I found the habit so broken up that I got grapes of great variety in color, shape and quality, some of them excellent, if I may trust my own judgment. From the original stock, black as night, I have obtained grapes white as the Chasselas, delicate of texture, and of a most agreeable flavor. I had planted these seeds promiscuously in beds of rich soil, and when these seedlings bore fruit, their seeds were planted in the same manner. This was not the best way. I raised many hundred more seedlings than I had need to, and should have succeeded more rapidly if I had planted only the seeds from the grapes showing the most marked change from the original type. I thought I multiplied my chances of success by putting all the seeds into the ground; I had not yet learned that nature makes constant efforts to return to her normal condition, and resents the interference of man. Her purpose is merely the continuation of the species, and she gives vigor and adaptation to that end. The horticulturist desires the fruit and not the seed. His efforts are directed to ameliorating the harshness of flavor, to softening the pulp, to making, in short, the fruit more edible. He accomplishes this by putting the seeds into a soil rich with stimulating composts, abounding with the particular food which is best adapted to his purpose.

The new conditions change the character of the plant. Instead of meadow or pasture where the parent vine grew with vigor, indeed, but with the coarse habit incident to wild nature, the new-born seedling revels in the abundant and congenial food prepared for it, and grows apace with cells and tissues enlarged, and stimulated by the nature of its feeding, and shows a change of habit more or less marked. In a bed of a thousand seedlings there will be vines showing a decided difference from the rest in shape and texture of leaf, length of joint, and shape and prominence of buds. These are the signs of improvement, of the *departure* from the native type, and the tokens of success to the cultivator. These vines deserve his special care; from them he will obtain vines with still more marked change of habit, and the greater the divergence from the original type, the more certain will be his success. In the third and fourth generations great differences of shape and size will be observable, and it is probable that size, color, or any particular quality could be established as a characteristic in the progeny of such grapes, by continued breeding from them. I do not advance this idea as a fact established, but a probability worthy the attention of the breeder.

Full details of all the facts and circumstances relating to grape breeding cannot be given in a brief essay like this, but it may be necessary to state that most of the seedlings, if you begin with the wild grape, will prove to be barren or worthless in the first generation. The barren grapes may be distinguished, for the most part, by their great luxuriance of growth, and, in *the first year*, the seed bed will be filled with those rampant, and, to the novice, promising vines. My experience leads me to reject these strong growers of the first year, or to plant them by themselves, as possibly I might get a good grape out of them, and if so, the strong habit of growth is desirable.

I have spoken of these seedlings of the first year, because the seeds continue to come up for two, three, and even four years, and my best grapes come from these later crops.

I think there is much probability in the theory propounded long ago, that one or more seeds of every fruit is strongly impressed with the peculiar type of the species to which it belongs, and will bring its like with precision, as happens with long established breeds of cattle. How far seeds of grapes are impressed with incipient change by stimulant composts, or modes of culture applied to the parent vine, is an interesting inquiry for the horticulturist. I may be able, when farther experiment has furnished me with more numerous and reliable data, to furnish to the public some facts in elucidation of this obscure subject.

I would strongly advise those who purpose to raise seedling grapes, not to go back to the wild vine, but to take seeds of new varieties, having the characteristics of vigor, &c., which they desire in the offspring. Plant the grapes whole, in rows to facilitate weeding. The placenta-like substance about the seed in the whole grape, nourishes the seed, and promotes its vegetative power. When the seedlings have grown one year, lift them out of the bed without disturbing the level of the ground. This can be easily done if the bed is thoroughly saturated with water, and with the aid of a fork to loosen the ground, while you draw the plant out carefully without breaking a single root. The second year another crop will come up; these will give a greater proportion of bearing vines. These are lifted in the same way as at first, to make room for the third crop which will succeed them. These last I save with the utmost care, as they will show the greatest improvement. When these seedlings are planted out they should be put into good soil enriched with bone-dust, ashes, and sulphur or plaster. These fertilizers I consider indispensable to the grape. Stable manures induce luxuriant growth of wood, but if applied to vines not carrying crop, give a lax tissue to the vine; if it is in crop you may safely apply them as top-dressing, to increase the size of the fruit, but many good cultivators believe it impairs the flavor of the fruit."

Soil. The best soil for grapes in this northern latitude is a warm, light, rich and friable loam, with a dry subsoil. If not naturally dry, thorough underdraining is indispensable, for with a wet subsoil the vines cannot long remain healthy, and with one sufficiently dry almost any soil easily permeable to the roots can be made to give good results. As a general rule good corn land is suitable for the grape, for like Indian corn it delights in warmth and requires it to bring the fruit to maturity. It need not and ought not to be so deep as most writers recommend. Ten or twelve inches is as great depth as gets sufficiently warmed in this latitude. It is usually recommended to have the soil very deep and very rich—to trench to the depth of several feet and to manure very heavily.* In warmer sections, with a longer season, this practice succeeds better than here, but is unsuitable to our needs. In order to get good fruit it is indispensible that we secure well ripened wood and as short jointed as possible, and deep soils heavily manured produce a late rank growth of shoots which cannot properly ripen in our short seasons.

Aspect. A gentle slope or side hill facing to the south is to be preferred. If varying from south it is better to southeast than southwest. The vine will, however, usually succeed in any aspect from southeast to southwest, but the warmer the better. Special attention should be given to *shelter* from the prevailing and most destructive winds. Tight board fences six or eight feet in height, at suitable distances, answer a good purpose in garden culture, but for extensive vineyards screens of evergreens are to be preferred.

---

* As a specimen I quote from Phin on Grape Culture: "Twenty inches is the least depth to be relied upon, and if very favorable results are desired it should be made three feet. The subsoil to this depth should be thoroughly loosened * * * adding at the same time a good supply of manure or compost. * * * For table grapes we doubt whether the soil can be too deep or rich," &c. Others go the length of recommending loading the soil with carrion by burying all the dead carcasses of animals and the like; which would be bad practice anywhere.

Manure. As a general rule, mineral manures, such as bone dust, superphosphate of lime, ashes and gypsum, are preferable to animal manures. Well decomposed composts containing stable manure are used to advantage at the time of planting, and should be well incorporated with the soil, which should be made rich enough to yield fifty or sixty bushels of corn per acre. Composts may also be used subsequently as a top dressing, as needful. Vines in full bearing are less liable to injury by animal manure than those carrying little or no fruit. Table grapes will also bear more to advantage than those intended for wine, as the flavor of the latter is affected injuriously by an application the effect of which may be wholly imperceptible in the former.

An excellent compost may be prepared as follows: To five or ten loads of meadow muck which has been exposed to a winter's frost, add twenty bushels of unleached wood ashes, ten bushels of fine bone dust, five bushels of gypsum, and seventy-five pounds of superphosphate of lime; the whole to be well incorporated and subsequently turned and mixed again. This quantity is sufficient for one acre, and the application need not be repeated sooner than three years.

Some grapes require a richer soil than others, as the Delaware, which rarely makes satisfactory growth unless the soil be richer than is needed for many others. The greater the natural vigor and the more luxuriant the natural habit of a vine, the less the amount of manure which is required.

Planting. A very common error with beginners in grape culture is to desire vines of large size, in order, as they think, to obtain fruit sooner than from small ones. It is true they may get a little fruit sooner in this way, but it will be at the cost of permanent weakness and lack of thrift. Whatever the age or size of a vine, it should be cut back close at planting, and the best vines are those of not more than two years' growth. A well grown thrifty vine of one year, with good roots, is greatly preferable for transplanting to one just as good in all other respects except that it is three, four or more years old. In case of the latter, it is impossible to save a fair proportion of the fibrous roots, the true feeders of the plant. It matters little whether they be grown from cuttings or layers, so they be well grown and well rooted. As a general rule the roots of vines should be planted about six inches in depth. Let the roots be evenly spread out in every direction, none crossing each other, and covered with fine earth. It is well, and especially if they be layers of one year, to cut off the ends of the roots a little with a sharp knife, as they are thus induced to send out more fibres. Autumn is the better season if the soil be dry and suitable for the grape, as they make better growth the following season. But if the soil be wet or heavy or liable to heave by frosts, planting is better deferred until spring.

The distance apart at which vines should be planted varies somewhat with the design of the planter. For vineyard culture eight feet apart is a good distance and from eight to twelve feet upon trellisses and against walls generally.

Pruning and Training. Volumes might be written merely to describe briefly the countless plans and modes of training and pruning the grape which have been devised and practised in different times. Were this paper intended for an elaborate treatise on grape culture it would be highly proper to describe those most in vogue, but as it is written for the use of farmers, who prefer to know one good way over reading about different methods, we will endeavor to point out plainly and briefly what we believe to be the best mode in a northern region like ours, and which is like the method commonly called spur pruning, and this in connection with training on a trellis, or on a continuous row of upright stakes (which serves very well as a substitute for a trellis), or against a tight fence or building. Arbors may do very well for a shade, but are quite too shady to ripen fruit well so far north as this.

When the vines are obtained from the nursery they are usually furnished with several shoots of the previous years growth. Some prefer to plant the vines as they are, and to let them make all the growth they will the first year, with a view to getting as much growth of root as possible. Most good cultivators prefer to cut back closely at the time of planting, and to let only three buds shoot from it, two of which are stopped when a foot long and the other trained carefully to make all the growth it may until August, when that one is stopped to ripen its wood properly. Adopting either method, the vine is to be cut back at the end of the season, and the next year two shoots only are allowed to grow, and all the others are to be pinched in. These are to be encouraged to make as much growth as possible. If trained to a trellis let them be laid in diagonally, with a view to training them horizontally the succeeding year for the permanent arms of the vine. Let them be stopped in August, as the wood should be as thoroughly ripened as possible. At the end of the season cut out all the laterals and shorten back the arms to a strong bud. The third year you will lay in these arms horizontally right and left, tying them to the lower wire of the trellis. If well grown, and the wood well ripened the previous year, these side shoots or arms will probably push every eye but you will allow only a part to grow. Select the most promising ones at about three feet apart and train them uprightly, rubbing out all the intermediate ones; pinch in all the laterals on the new shoots at the second leaf and pinch the upright shoots when they reach the top of the trellis. If a strong healthy growth has been attained these upright shoots may be left at the fall pruning nearly their whole length, for bearing the year after—but if the growth is weak let them be shortened accordingly. The following year these upright shoots may be allowed to bear; probably every eye will push and show fruit, but *only every other one* should be allowed to bear and this one to carry *only one bunch*—all the rest must be taken off if permanent health and vigor be desired in the vine. It requires some nerve in the beginner to destroy three-fourths or more of the promise of fruit, and if not fully convinced of its necessity he will leave too much on, and find out too late how serious is his error. This thinning out of the fruit is best done when the berries are of the size of peas; the best and best placed bunches only should be reserved. No single item in grape culture is of so much importance as the reduction of the amount of fruit which the vine shows, to such an amount as it can carry *and ripen well and early,* without injury in subsequent years. From what I have seen, the opinion is firmly held that if two-thirds of the fruit which is left on the vines in this State was removed at the proper time, the value of the remainder would be double what it is, to say nothing of earlier ripening and permanent vigor and productiveness, which are two very important considerations.

The side shoots from these upright canes may be allowed to grow as far as they will without much over-lapping of each other, and then stopped. The laterals also should be kept pinched in. Your vine is now established in permanent form, and all the future pruning necessary is to cut back these bearing shoots at the fall pruning, leaving spurs of one or two eyes to bear the year after. This mode of pruning is called spur pruning and is deemed the best for out door grapes in this latitude. When these spurs push their eyes in the following spring rub out all but *the best one* and treat this as last year. If this be not done you have a thicket of weak wood and foliage, of no value, in place of a suitable number of strong productive shoots. The vine should be allowed as much foliage as can be fully exposed to the sun and air, and no more. It needs so much to elaborate the juices taken up into nourishment for the fruit, and too many leaves are as hurtful as too few. Leaves should never be removed to let the sun shine directly on the fruit, for the ripening process is effected entirely by and through the action of the sun and air on the leaves. Where space is abundant vines may be trained horizontally near the ground in a fan shape or circular form, four or more branches being allowed to start from the stem and diverge in different directions, being supported by a suitable number of stakes at a foot and a half or two feet from the ground. I have seen this plan attended with remarkable success in several cases, especially in light sandy soil; the maturity of the fruit being apparently much hastened by reflected heat from the ground, and showing as favorable results as when grown against a wall.

Time for Pruning. The general pruning should be performed soon after the leaves fall in autumn, as this practice, it is believed, tends to hasten the maturity of the fruit, as well as obviates all liability to the bleeding which occurs if pruning be deferred until spring. Thinning out a vine by removing all needless shoots, is an important part of pruning and training, and is best done by rubbing off with the finger, in June, as soon as the buds have attained two or three inches growth. In this way all the strength of a vine can be directed to the fruit bearing shoots, instead of being wasted by the growth of useless or injurious wood which must be afterwards cut away.

Ringing or Girdling. The practice of ringing or girdling portions of the vine is sometimes resorted to for the purpose of hastening maturity and also of increasing the size of the fruit. It is done by taking off a portion of bark below the fruit about half an inch in length by cutting clean to the wood, and then removing the ring of bark between. This should be done, if at all, as soon as the fruit is set or before it is larger than peas, and should be practised only on branches which may be wholly removed in the fall, such ones being wholly useless for future bearing. It may be done on the shoots of the present year or on older canes bearing many bunches. Occasionally it may be done to advantage, but it is not advisable to practice it extensively. A suitable *thinning* *out of the bunches of fruit* when quite small, is the true method of hastening maturity and is always safe and expedient.

Grafting. Grafting the grape vine in order to change the fruit of inferior sorts or of barren or worthless seedlings to a better variety is sometimes desirable, but the process is more difficult and uncertain than in the case of fruit trees. It is usually practised by cutting off the stock at or below the surface of the vine and inserting scions by the usual mode of cleft-grafting. I have been oftener successful by inserting scions into each of the main roots at a little distance from the stem thus multiplying the number of scions and the chances of success. There is a difference of opinion as to the preferable time for the operation. Some graft very early in spring, and others wait until the leaves appear and the rush of sap has diminished in force. Mr. Fuller, in the "Grape Culturist," advocates grafting in autumn and protecting the parts from frost by an inverted box or flower pot covered with straw and earth, and asserts that by this mode almost as much growth is attained as the original vine would have made. Grafting upon pieces of root, I have found a successful method of propagating sorts which strike root from cuttings with difficulty,—like the Delaware and some others. After a year's growth or when finally planted out, vines grown by this method should be set deep enough to throw out roots from the scion and thus become permanently established upon their own roots—as with vines grown from eyes, cuttings, layers, &c.

Old vines may be successfully grafted by the mode known as "grafting by approach" or "inarching," a young vine of the sort desired being first planted as near as possible to one to be operated on, and when established, the two are *inarched*, and when fairly united the old vine is cut away and its whole strength thrown into the new one. This method requires more skill than ordinary grafting, but properly done is very satisfactory.

Winter Protection of Vines. Grapes are sometimes spoken of as hardy, very hardy, half hardy and tender. As there is no standard of hardiness, these terms are to be understood comparatively. The Isabella is considered a hardy sort in New York, and it is usually left there without protection, yet it sometimes suffers badly, and in some parts of the State is occasionally killed to the ground. The Delaware, Concord, Muscadine and many others do the same here; mature vines will often grow pretty well after a winter's exposure. Yet I have never seen any which were not benefited by being laid down and slightly covered, enough to pay abundantly for the trouble it costs. In our short seasons we need all available helps to early ripening of fruit, and vines which are protected start with much greater vigor and make more rapid progress to maturity of fruit than those left exposed. I would recommend therefore that in all cases the vines be laid down. As the winter snows are usually quite sufficient to cover them, there is little need of much else. Boughs of evergreens serve the best purpose, and as they are in most cases easily obtained, are usually employed. Along the sea coast, or in other places where snows are less abundant, the covering may be used more plentifully. As it is not simply cold but rather alternate freezing and thawing which injures them, protection is to be given with this fact in view.

Enemies. Few cultivated fruits are less subject to the attacks of insects or diseases than the grape. In some sections of the country several sorts of beetles are troublesome, and occasionally the rosebug has committed severe depredations, but in this State I have never seen them numerous enough to cause trouble.

Of diseases, there are two which are sometimes serious, viz., the rot, which affects the fruit, and the mildew, which chiefly attacks the foliage. The rot is a disease which first shows itself by discoloration just beneath the skin, and arrests ripening. When severe it causes the berries, sometimes only a few and sometimes the whole bunch, to shrivel and perhaps drop off. The Catawba and its seedlings, such as Anna, Diana, &c., seem more subject to it than other varieties; in fact, I have noticed it here only with these, if we except the Concord, which during the past season for the first time has showed occasional berries affected in a somewhat similar way; some of them showing a deep red blotch as they begin to color, the ripening process being at once arrested. The most probable cause of this disease is a wet subsoil. At any rate we know that stagnant water is baneful in its effects upon the roots of the grape, as well as upon other fruits, and should always be avoided, and I have never seen the disease in this section of the country except upon lands underlaid by a wet subsoil.

What we call mildew is either identical with or closely analogous to the vine disease of Europe which has of late years proved so destructive. It is, more properly, a sequence, or accompaniment of disease, than a disease of itself. Mildew is a minute fungus or parasitic plant which attaches itself for the most part to the leaf, and draws its nourishment from it, soon destroying vitality if not arrested. It rarely or never attacks perfectly healthy vines, but only after they have become weakened by unfavorable atmospheric or other influences. It usually appears late in summer, after a spell of wet, foggy, muggy or changeable weather, and at such times the vines should be closely watched so that it may be taken in hand at once, as its progress is sometimes very rapid. Some localities are much more liable to it than others, and some are almost free from it. Some varieties are also more liable than others to its attacks. Generally, the thinner and more delicate the foliage the greater the liability. Mildew first appears as a white speck and usually on the under side of the leaf; this speck is soon surrounded by others, and sometimes it extends quite rapidly, in which case the leaves ere long change color and lose their vitality. When this occurs, the ripening of both wood and fruit is arrested. Much can be done in the way of prevention by securing healthy conditions for the vine, as a dry soil, sheltered situation, proper food, &c. When it appears, it should be attacked at once with sulphur. This is so effectual a remedy that Sicily, we are told, has been more than compensated for the injury to her grapes from the vine disease, by her increased exports of sulphur used for counteracting its effects in other countries. Waltershausen estimates that the consumption of sulphur in the vine growing countries of Europe, for this purpose alone, amounts to 850,000 *centner*, or more than forty thousand tons. It is said also that this demand has largely increased its price.

This antidote is applied in various ways; sometimes in powder by dusting it upon the leaves; but the best method, decidedly, which I have found, is by using a solution made with lime, in water, applying it with a garden syringe, showering especially the under side of the leaves. It may be prepared as follows: Take two or three pounds of flowers of sulphur (which having been sublimed is in a very fine state of division; roll brimstone or or crude sulphur being unsuitable), put it in a barrel together with two or three times as much of the best quick-lime, and gradually add hot water, stirring constantly; as the lime slakes the liquid boils and more water is added until the vessel is conveniently full; when the liquid settles clear it is ready for use. If deeper than a pale straw color it may be diluted before use, although I have found no injury from applying it in the strength above indicated. The vessel should be kept very closely covered, as, if the air be admitted, the solution decomposes, precipitates the sulphur and loses its efficacy. Hot water may be subsequently added to the sediment, as long as the liquid shows by its color that it takes up a portion of sulphur. Its application to the vines should be kept up until the disease is manifestly subdued. Sometimes one application is sufficient and sometimes several are required.

Perhaps it may be well in conclusion to recapitulate some of the more common errors in grape culture, which are :

1st. Neglect of pruning and training during the earlier years of its growth. Where so neglected it is impossible to get the vine in good form subsequently without cutting down and beginning anew from the bottom.

2d. Allowing too many upright canes, the consequence of which is a crowding of the bearing shoots proceeding from them, weak wood, small bunches, imperfect ripening, &c.

3d. Neglect of thinning out the weaker shoots from the spurs early in the season, which also results in a profusion of weak wood, crowding of shoots and of foliage, small and poor fruit, &c.

4th. Neglect of properly thinning out the fruit. No vine, *whatever its age when planted, ought to be allowed to bear before the third year*, and then not more than a third of what it shows ; after that, from one-half to two-thirds should be removed as soon as the bunches are well formed.

Varieties. The number of varieties which have been proved in this State is very large. The number which have given ample satisfaction is very small. Of these the Delaware and Hartford Prolific take the lead. Others, however, possess qualities which entitle them to a place in every good collection.

Among the newer sorts of which we have too little experience to enable us to speak with confidence, there are several regarding which the testimony of cultivators and good judges elsewhere, is such that they may be planted in strong hope that they will prove very valuable acquisitions to our limited list of really good sorts. It should be borne in mind that the fact of any given grape proving good in one locality is not conclusive evidence that it will succeed equally well in another, and this aside from difference in its time of ripening ; and no grape can be deemed to be fairly tested until it has borne fruit for at least five years, and ten or fifteen would be much more satisfactory.

Delaware. This is unquestionably the finest flavored and richest grape which has been found to succeed in open culture in Maine. When the wood is properly ripened it is one of the hardiest, and it is plentifully productive. Its period of ripening is with the Hartford Prolific and other very early sorts, or commonly from 10th to 20th September. It requires a rich soil and good treatment if we would develop all its excellencies. Being more reluctant to strike root from cuttings than almost any other grape, it is somewhat difficult of propagation, and vines from the nursery are necessarily smaller and more delicate than many other sorts, but when once established, the vine makes a good growth, although its habit always less luxuriant and more delicate than such coarse growing sorts as Isabella, Concord, Diana and the like. It is believed to have originated in New Jersey and to have been carried thence into Delaware county, Ohio, where its excellence was first made known to the public through Mr. Thompson, who also disseminated young vines. Our first vines were obtained from him in 1855, and our estimation of its value has steadily increased ever since.

Bunch medium to small, compact, usually shouldered. Berries small, skin thin, beautiful bright red passing into wine color. Flesh free from pulp or acidity, exceedingly juicy, sweet, vinous, rich and aromatic.

Those who prefer quantity to quality, profit to real excellence, and to have their vines bear abundantly with the least possible amount of care or attention, will not plant the Delaware so largely as the next in our list.

Hartford Prolific. In the present state of grape culture this is believed to be on the whole the best adapted for extensive and general cultivation in Maine, inasmuch as it will grow and bear and ripen its fruit in almost any soil or situation and with almost any treatment or lack of it; though of course, greatly better where properly cared for. It was introduced by Mr. Paphro Steele of Hartford, Conn., about 1851 or 1852. Being in Hartford early in September, about that time, we visited the original vine which we found to be a chance seedling which had sprung up in his pasture and was rambling over some bushes, giving little evidence of pruning or care of any kind, but evidence enough of productiveness and early maturity. The quality too was better than we had ever seen connected with its other excellencies. The opinion was formed that it promised well for cultivation in Maine. A dozen vines were engaged and the twelve years experience with it since then has resulted in the opinion above given. Some have complained of it for not being wholly free from the native aroma, some because it does not always hold its berries so well as might be desired. It must be acknowledged to be open to criticism in both these respects, but with fair treatment neither of them are very serious objections; while for combined health, vigor and freedom from mildew or other disease, for hardiness, productiveness and certainty of ripening a crop of fruit of good quality we have found no other equal to it. Old Colony is considerably earlier; Union Village a good deal larger, Delaware decidedly better, and others may surpass it in some other respects, but taking it altogether we consider it the best for extensive cultivation which has been fairly proved *thus far*. It is coming to be more highly appreciated where the season admits the culture of later ripening varieties and perhaps no other sort is now more extensively planted *for profit* in the middle States than this.

Such is its productiveness that it requires to have a *large proportion* of the fruit thinned out if we would not have the vines weakened and would have the fruit in perfection and early. I have not found two-thirds or three-quarters too much to remove. What is left is so much larger, better and earlier as to be worth much more than the whole would be if left on, besides which the vine is left in vigorous health and strength.

Bunches large, shouldered; berries large, round; skin black, with a little bloom, flesh rather pulpy, juicy, mingling sweet with acid and some native perfume. Ripens about the middle of September.

NORTHERN MUSCADINE. This grape was introduced by the Shakers of New Lebanon. By them and by some others it is extolled as being the best of all grapes. By some others it is decried as utterly unworthy of cultivation. The facts are, that it is very hardy, very early, sufficiently productive and strongly charged with the muskiness or foxiness peculiar to our wild species. With those who like this, and they are many, it is a great favorite. There are those who cannot endure the odor. Aside from this foxiness, which being a matter of taste, is not a point to dispute about, it combines many good qualities, being sweet and rich as well as hardy, and so early as to be almost sure to ripen a crop in any season. It has the fault, very serious for a market grape, of shedding its berries from the bunch as they ripen. On the whole it is a grape which will give good satisfaction to a great many.

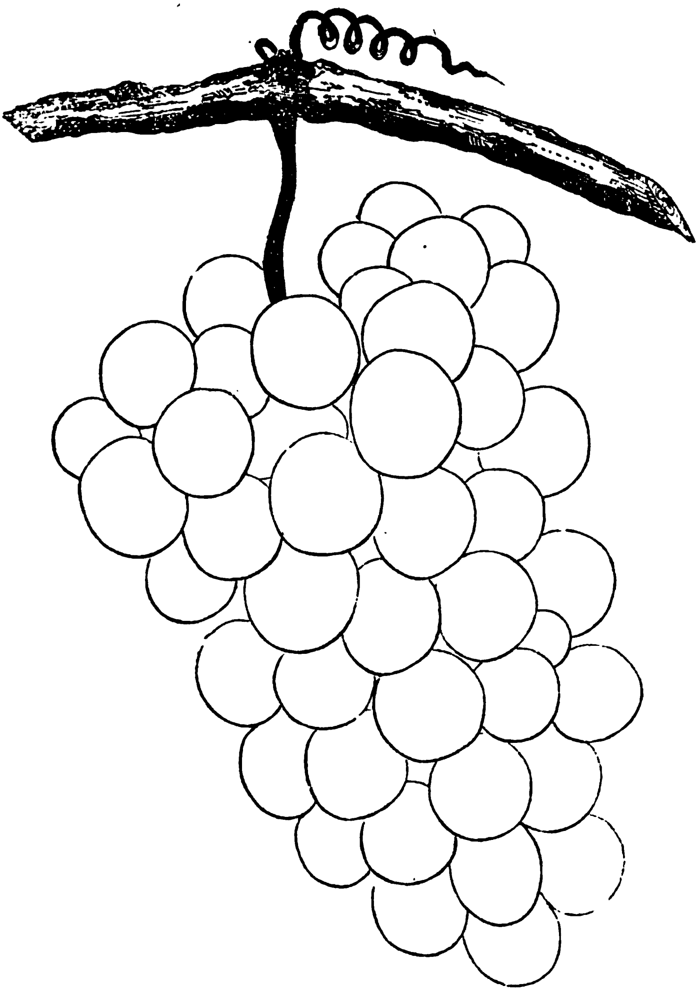
Bunches medium size—berries medium, brownish amber colored, flesh pulpy and sweet, foxy. Ripe about middle of September.

CONCORD. This was originated by Mr. Bull of Concord, Mass. When well grown it is one of the largest and finest grapes we have; very handsome in both bunch and berry. Although usually ten days or more earlier than the Isabella, it is a week or more later than the Hartford Prolific, and should have a favorable situation in order to ripen its fruit fully. It needs less pruning than some other sorts, and, like many others, the fruit is earlier and greatly better on old vines than on such as have just come into bearing. The earliest and best fruit I have grown was from a vine trained horizontally near the ground, (as mentioned at page 149,) and pruned very little. At the South and West this variety is becoming more and more highly esteemed every year. To develope its capabilities fully, a longer and warmer season than ours is required.

DIANA. A seedling of the Catawba, originating in Massachusetts, which has with many obtained a high reputation, and which in perfection is second to very few others in quality. It is liable to considerable variation in quality even in places not remote from each other. Its time of ripening, being rather later than the Concord, demands that it should be planted only in very favorable locations. In my grounds it has proved more liable to the disease called "rot" than any other, but I have heard of no complaint of this from other cultivators in the State. It begins to ripen scattering berries toward the end of September, which are sweet as soon as well colored, but the bunches are not fully ripe until some weeks later. It may be kept during winter with more ease than any other I have known.

REBECCA. A fruit of the highest excellence, being, when fully ripe, unsurpassed by any other in delicacy and richness of flavor, but the vine is rather tender and of delicate growth, and its maturity rather late for this latitude. Were it sufficiently early, hardy and vigorous, it would leave little to be desired. As it is, it should be planted only in the most favorable situations.

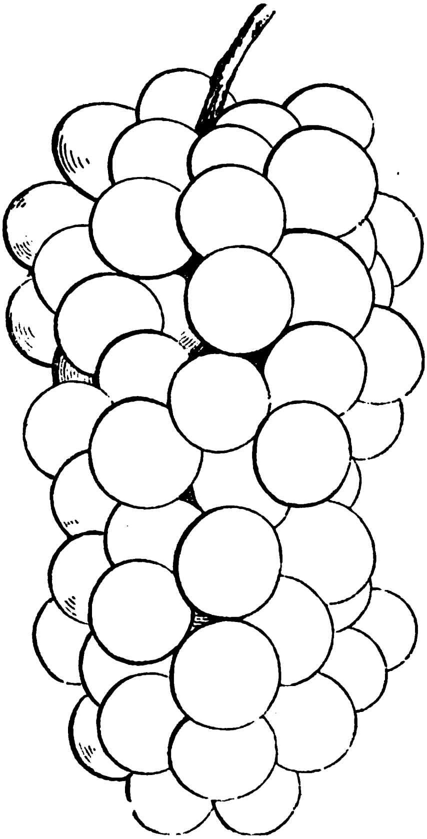
EARLY HUDSON. A very good grape and one of the earliest, but we have discontinued its cultivation from its failure to set its fruit well, leaving only a few scattering berries of full size in each bunch, besides which it forms a larger number of small ones which are destitute of seeds.



DIANA.

Union Village. The largest and handsomest native grape we have ever seen. The vine is a prodigious grower, and rarely if ever ripens its wood sufficiently to withstand the winter, and in consequence it often suffers severely. It is also rather too late for this latitude, being hardly more than a week earlier than the Isabella.

Clinton. A rather small, black grape, with a compact bunch, which colors early, but is unfit to pluck until its harshness of flavor has been meliorated by the early frosts. Scarcely worthy of being planted now that we have better ones, although on its introduction fifteen or twenty years ago its vigorous growth, productiveness and extreme hardiness rendered it a desirable acquisition when we had none earlier or hardier than the Isabella.



REBECCA.

Old Colony. This is the earliest grape, without exception, which has fruited here. Bunch and berry of good size and the berries adhere well until they shrivel almost to raisins. It is one of the best common native grapes, and for its early maturity desirable to plant in the northern part of the State. It ripens a week or more before the August Pioneer, Jennings and some others which have been recommended as being the earliest sorts known.

BLOOD'S SEEDLINGS. Of these there are two. The black colors very early and ripens rather late; when fully matured it is as pleasant as any of its class. The white resembles the Northern Muscadine, except that the berry is larger and the bunch rather smaller. Both have the thick skin, firm pulp and other characteristics of the common natives, and with those whose tastes have been formed on these as a standard of excellence they are esteemed as valuable.

Among the sorts which have been tried in this State and found wanting in some indispensable characteristics, either of vine or fruit, or are of too late maturity to render them desirable compared with some above described, may be named the To Kalon, Anna, Charlestown, St. Catherine, Franklin, Taylor's Bullitt, Garrigues, Arkansas, Eliza, Emily, Baxter, Marion, Oporto, American Hamburg, Massachusetts White, King, Cowan, Warren, Logan, North America, Dracut Amber, Canby's August, York Madeira, Comstock, Columbia, Ruband, Cutter, Miner, Graham, Catawba and Isabella.

NEWER SORTS. So great has been the enthusiasm in regard to grape culture in the Northern States, and so plentiful the production of new seedlings, which, viewed with the eye of parental fondness and partiality, have been thought by their originators to be worthy of general cultivation, that it would be impossible to give even the names of all which have been brought forward with high encomiums within a few years past. Some of these will undoubtedly prove as good, and very likely even better than any we have proved thus far, and probably the great majority of them will drop out of notice as fast as they are proved.

Many of our readers are probably desirous to know what evidence appears regarding the quality, earliness, or probable value for culture in a location so far north as ours, of some, at least, of those which have been most persistently pushed into notice and of which small vines are now for sale at high prices. Having endeavored to obtain reliable information, the attempt will be made to respond according to our best knowledge and belief.

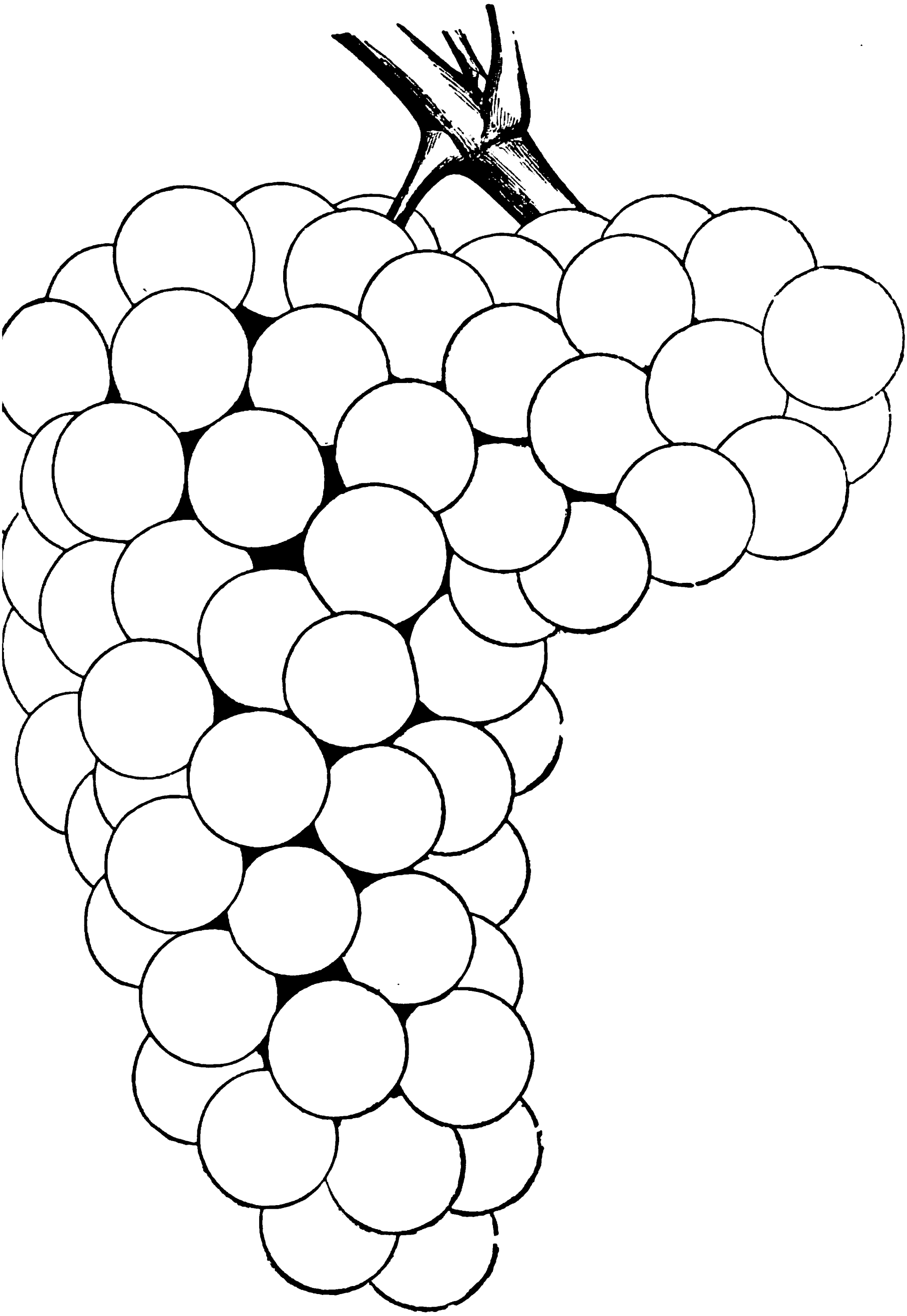
Among the more prominent and promising of these new sorts are the ADIRONDAC, IONA and ISRAELLA. The first originated with Mr. Witherbee, at Port Henry, in the northern part of New York, and has been disseminated by J. W. Bailey of Plattsburg. I saw the fruit at the meeting of the American Pomological Society, at Boston, Sept. 17th to 19th, 1862. The Committee on New Fruits reported of it as follows: "Bunch large, compact; berries large, round; color dark purplish red, with a blue bloom; seeds large; flesh greenish white, soft, not perfectly ripe, but promises excellently well." Mr. Hovey visited Mr. Bailey at Plattsburg (September 3d,) and in a late number of his magazine says: "It is only three or four years since it was planted in his grounds, but the oldest vines had begun to bear, and to our surprise we found the grapes quite well colored, and would soon be ripe. As regards vigor, we could see little difference between it and the Isabella or Hartford Prolific on the same trellis. Its comparative period of ripening was our next object; this was obtained by tasting the Hartford Prolific and Delaware, which were not so much advanced as the Adirondac."

The two others above named are seedlings grown by Dr. Grant at Iona, an island in the Hudson near Peekskill. The Doctor is well known as an enthusiastic cultivator and has done much to disseminate the Delaware. The one he calls IONA is undoubtedly a grape of high excellence, larger than the Delaware, and like it of a deep wine color when ripe. It will also probably be found to vary but little from the Delaware in its period of maturity, and the prospect is that it will soon be ranked among those most worthy of extensive cultivation.

The ISRAELLA is a dark colored grape of good quality, said to to ripen a week or more earlier than the Hartford Prolific. If such proves to be the case here it will be of very great value.

The CREVELING is not particularly new, having been cultivated to some extent for nearly ten years, but of late it has gained favor with many, and the demand for it has become so great that its price, instead of receding as usual after being largely propagated, has enhanced, and the call for it continues to be large. It has not yet fruited here long enough to speak of its merits from personal knowledge, but elsewhere it has exhibited the quality, earliness and other good properties of the Hartford Prolific, without any liability to drop from the bunch. The only objection made is that the bunches are not sufficiently compact.

ALLEN'S HYBRID has been before the public for some years. It partakes of foreign origin and has much of the character and appearance of the Chasselas. When fully ripe it is of honied sweetness, as desirable in its way as the peculiarly rich flavor of the Rebecca, but like the last named it cannot be depended upon



ISRAELLA.

to ripen fully in the open air in Maine except under very favorable circumstances.

E. S. Rogers of Salem, Mass., some years ago attempted the hybridization of the native with the pollen of the foreign species, and has sent out forty or more of his seedlings, under numbers. Some of them are very large and beautiful and have attracted much attention. Nos. 3 and 9 are said to be among the earliest, and Nos. 4, 15 and 19 to be the best in quality. It seems probable that some of them may attain an established reputation where the season is long enough to admit of their ripening fully, but evidence of sufficiently early maturity in any of them for this latitude is, as yet, wanting.

Regarding some newer sorts which have been introduced to notice with high recommendations, such as the Winchester, Cuyahoga, Framingham, Maxatawny, Miles, Lydia and several others, we are not prepared to express any opinion.

THE CURRANT.

The currant is one of the most valuable of the smaller garden fruits, being exceedingly wholesome as a dessert fruit in its season, and is used in various ways in domestic cookery, as for pies, tarts, jam, jelly, shrub, and in fact in almost every way in which fruit may be applied. A jelly from the Black currant is one of the most successful remedies known in bronchitis and other forms of sore throat where an astringent is needed. Were its virtues better known, it would greatly displace nitrate of silver and other powerful agents now used.

The flavor of the black currant is at first disagreeable to many, but generally they soon become fond of it. I have never known children to be averse to it, nor for them to be affected with summer complaints while having free access to the fruit. The white currant, being less acid than the red, is generally preferred for the dessert. From red currants, with the addition of refined sugar, a wine may be made which, properly made and with suitable age, is not only wholesome and palatable, but closely resembles a pure grape wine, and may be used in its place.

The currant is perfectly hardy, thrives in various soils, and comes to as great perfection in Maine as in any part of the world. Its propagation and culture are of the easiest possible, and it deserves a place in every garden, and to be more extensively cultivated than it is. Being so easily grown, it is too often utterly neglected, and in many cases where it is grown it receives no culture at all. Under such circumstances the fruit is very inferior to what may be produced with a little care.

In the neighborhood of large towns, where the fruit is put up in cans for shipping, and where large quantities of jelly are made, it may be a very profitable crop, often yielding several hundred dollars per acre.

Currants are propagated by cuttings, and the culture required is simply to prepare the ground properly by digging, manuring and planting out the young plants in rows four feet apart and three feet asunder in the rows, and subsequently keeping the ground clean and free from weeds, manuring as often as necessary to keep up the size and productiveness of the plants. If they grow vigorously, it is well to shorten in the strong young shoots annually, and remove wholly the weak ones. By this pruning the bush is kept in better form and larger fruit is obtained.

Varieties. In some sections of the State the common old fashioned red and white varieties are still cultivated. In others the red and white Dutch have been introduced, which are larger and better, and for some years were considered the best to be had. Still more recently, however, we have introduced newer sorts from English and French cultivators, which greatly eclipse them, and these are just beginning to be disseminated.

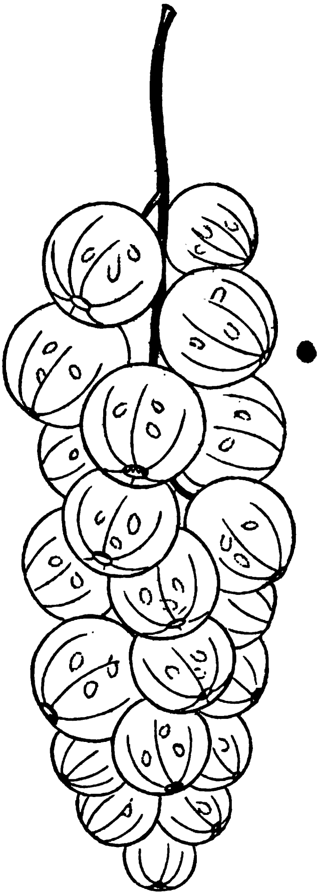
Red Currants.

RED DUTCH. Of good size, productive and of good quality; excellent for cooking, jams, jellies and wine. There are several subvarieties of this, bearing longer or shorter bunches, but the difference is slight.

VICTORIA, OR RABY CASTLE. Originated by an English cultivator, Mr. May. It has longer bunches than the preceding, and ripens late, thus forming a succession, and often hangs on in favorable seasons until late in September.

CHERRY. A comparatively new sort of exceedingly vigorous growth and with fruit of very large size. Until the plants have attained full growth, it has proved but a shy bearer, and the fruit is more acid than some others; bunches short. Within a few years a sort has been imported under the name of Long-bunched Cherry, which bore much longer bunches during the past season, with berries equally large.

La Versaillaise. A new variety of French origin, of the largest size, exceedingly productive, of better quality than the Cherry, and the plant a vigorous grower. Its size, beauty and productiveness render it a great favorite. The drawing we give of this sort we take from fruit grown under high cultivation, in good soil, with the plants well pruned and cared for. We have grown the fruit frequently to measure five eighths of an inch in diameter or nearly two inches in circumference. To secure growth of this size, the ground must be well trenched and deeply manured, and the plants well grown and closely pruned. The variety imported under the name of *La Caucasse* seems to be identical with the above.



LA VERSAILLAISE.

La Hative. From its name we would expect this to ripen earlier than the others, but have not been able to distinguish a very marked difference in this respect. It is as large as the Versaillaise, very productive, handsome and good; very desirable.

WHITE GRAPE.

La Fertile. This and the two preceding were raised by M. Bertin of Versailles. It is suitably named, being a prodigious bearer, fruit of very large size and similar in quality to its congeners. Will be a general favorite.

Red Imperial. Another new French sort of the largest size and very productive. Has so far proved a less rapid grower than the above named sorts.

Knight's Sweet Red. Of English origin and less acid than any other currant we have grown. In other respects it is not much unlike the Red Dutch, though hardly so free a grower.

Some of the newer currants have not fulfilled the expectations entertained of them, as *Fertile de Pallua*, which, although very productive and rather early, has no special excellence. The last remark also applies to *Fertile de Angers* and several others.

Macrocarpa is of largest size, but hitherto has proved but little more productive than the Cherry currant.

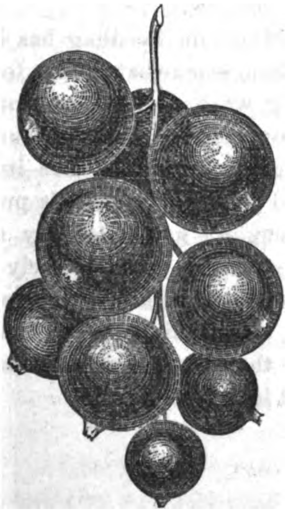
Gloire des Sablons, imported at high cost, proves to be similar to an older striped variety, and desirable chiefly as a curiosity.

White Currants.

Of these we find no marked difference between the large White Dutch and White Grape, in their fruit. There is some difference in the habit of the plants. Both are large and fine and very desirable. White Gondoin has a longer bunch and the plant longer shoots than most others. White Imperial has, during the past year, proved rather larger than any other. It is of very late introduction, and comes highly commended. White Transparent is a new French sort resembling White Dutch. Under high culture it gives berries and bunches of very large size.

Black Currants.

Of these the Black Naples and Ogden's Black have proved the best, and deserve more attention than they have received. In



OGDEN'S BLACK.

many gardens the only black currant grown is one much later in ripening, very insipid in character, and quite worthless compared with the above.

The Gooseberry.

The gooseberry is a useful fruit for the dessert, and also for tarts, jams and other culinary purposes. The varieties of the foreign gooseberry are far more numerous and varied in size, color and flavor than the currant; in fact they are almost numberless, and embrace white, red, yellow and green—small and large, up to an ounce or more in weight. But unfortunately in our climate they are all so liable to be ruined by mildew, that their culture has almost been abandoned.

In our indigenous species, however, we have a plant perfectly fitted to our climate, and although little has yet been done to improve it by rearing new varieties from seed, that little has accomplished so much that we may hope, now that its wildness has been fairly broken, for numerous varieties giving a larger range of color, size and flavor. The first success in this line was the production some twenty-five years ago of Houghton's Seedling by a person of that name, at Lynn, Mass. It is of pale red color and of moderate size, but possesses a thin skin and a fine flavor, equal in quality to the English gooseberry, is extraordinarily productive and always free from mildew.

A sort called the Mountain Seedling has been disseminated by the Shakers of Lebanon, somewhat similar to the above.

The finest seedling we have seen, of our native species, was grown by Charles Downing, Esq., of Newburgh, from seed of the Houghton. It is considerably larger than its parent, color a light green, flavor rich and good. The plant is productive and its habit more erect than Houghton's. It is very scarce and but little known as yet, but deserves to be extensively disseminated.

The gooseberry succeeds with very simple cultivation. A rich soil free from weeds, and pruning enough to remove the weak and ill-placed shoots, are the chief requisites. It is easily propagated both by cuttings and layers.

THE BLACKBERRY.

During ten years past or more the blackberry has attracted considerable attention in various parts of the country, and several improved varieties have been introduced to cultivation. Among these, the most prominent are the NEW ROCHELLE and the DORCHESTER. The first named, sometimes also called the Lawton, is quite large and handsome, and when *fully ripened*, which is not until some time after it is fully colored, is sweet, rich and very good. As I have seen it in the Middle and Western States, it is a very desirable fruit and worthy of extensive cultivation. The Dorchester is about the same size, but of more elongated form and in quality equal to the New Rochelle. It is also rather the hardier of the two, but neither of them will pass through average Maine winters, unless covered with snow, without having their canes either winter-killed or so much weakened as to produce only a scanty crop of small, poor berries. The canes are too stiff, and with the New Rochelle too branching also, to be laid down and protected to advantage. It is with the cultivated as with the sorts found growing wild in our woods and pastures. After an unusually mild winter, like the last, or after one during which the canes have been well protected during the severe weather by a covering of snow, we have fruit, more or less, and from fair to good; in other winters we get none or little and poor.

I have known many attempts to cultivate various sorts of the blackberry in Maine, have myself grown a dozen or more of those most highly recommended, but I have never learned of success at all commensurate with the cost and trouble. Several new sorts have been introduced too recently to speak of them with confidence, some of which *may* prove hardy enough to warrant cultivation. So far as my own observation extends, some of those bearing white, or more properly, pale colored fruit are hardier than the black fruited sorts.

ON THE BEET ROOT AS A SOURCE OF SUGAR.

Among the incidental benefits which will accrue from the great struggle in which we, as a nation, are engaged, not the least may probably be an emancipation, more or less complete, from dependance upon other countries for articles of daily use. This will come to pass through the creation of new branches of industry and by the development of existing resources and facilities for some production hitherto unimproved. The new burdens and duties laid upon us call loudly for exertion to meet them; and no people under heaven are better able to respond to the call. We were never so wedded to slothful habits or traditional methods and customs that a new enterprise promising sufficient pecuniary reward would not be readily undertaken; and now, whatever of routine we formerly had has been thoroughly broken in upon, all are minute men ready for any call. If the war has taxed our means it has aroused our energies. If it has disturbed peaceful pursuits, it has developed unsuspected strength and has shown that we have unequalled elements of greatness. Something has already been accomplished towards achieving this independence of foreign countries, and much more may be done. I desire now to call attention briefly to one or two articles. The consumption of sugar in the United States is about 660,000,000 pounds, of which about one-third only, (including the product of Louisiana and Texas,) is produced within its borders. For the balance an annual expenditure of some thirty to forty millions of dollars in specie is required.

The production of maple sugar at the north has largely increased for a few years past, and were this tree as easily brought to maturity as an annual or biennial plant, doubtless the production would be more rapid still. In the *beet root* is a resource which has been successfully drawn upon in other countries, and no reason is known why it may not equally prove available here.

Some facts regarding the history of beet sugar industry may therefore be interesting at this time. When France was involved in her great first revolution which drew the other nations of Europe upon her, and afterwards through the Directory, the Consulate and the Empire, every resource was strained to its utmost capacity.

During twenty-five years of exhausting war, shut out from the seas and thrown back upon herself, new and mighty energies were born of her extremity; agriculture and manufactures were extending, new branches of industry were erected, unthought of resources developed, until at length the nation emerged from her struggles more self-sustaining and stronger than ever before. Among her first needs forced upon her by this war, was a substitute for cane sugar. As early as 1747 a Prussian chemist discovered sugar in the beet, but his process would not make it at moderate cost, and the discovery was, at the time, unfruitful. Nearly fifty years later, another chemist, Achard, discovered a practicable method and published the details of the process. In 1810 Napoleon offered one million of francs for the first successful beet sugar factory which might be established. In 1812 he ordered the formation of five public schools in which nothing but the manufacture of sugar was to be taught. Each pupil was to receive one thousand francs after three months faithful attendance, and every one who would engage in raising beets or making sugar was to be relieved from taxation during five years. In 1813 Napoleon ordered that four imperial castles should be converted into sugar factories, and their parks be planted with beets. His orders were in process of execution when France was invaded by the coalition of other European nations and he fell from his throne. Meanwhile cane sugar had so accumulated in the colonies and warehouses of England that prices were greatly reduced, and English farmers used it to feed to cattle and swine. With the fall of Napoleon the beet sugar manufacture lost its support; all the establishments for making it were ruined, and the very idea was ridiculed. By degrees ridicule gave place to more correct views, and in about ten years, in 1825, not far from thirty establishments were again under way. Beet sugar was then free of impost, while colonial sugars were charged 53 francs per 100 kilogrammes, or about 4½ cents per pound. The manufacture soon became so successful as in large measure to supplant the foreign article, and the revenues began to suffer. The nobility then ruled France, and being deeply interested in the colonies, a heavy tax was soon imposed on home-made sugar, but in spite of this the manufacture was continued, and many improvements being introduced, it has gone on with varying success. In 1848, the duty on beet sugar was 50 francs, and on West Indian 44. It is now the same on all.

Official reports state that in 1857 there were 283 factories in operation, making 83,126,618 kilogrammes of sugar. In 1858, there were 341 factories making 151,514,435 kilogrammes of sugar. The kilogramme being two and one fifth pounds, the product in 1858 was 333,331,757 pounds, and the duties paid amounted to 63,861,200 francs, or upwards of twelve millions of dollars.

In Austria, the number of beet sugar factories in 1858 was 109, of which 52 were in Bohemia, 34 in Silosia and Morovia, 15 in Hungary, and 8 in other portions. They consumed 10,551,000 cwt., and reported a product of 7½ per cent. of sugar, or upwards of 36,000 tons.

In the Zollverein, in 1858, there were 251 factories, consuming 28,409,674 cwt. of beet roots, and the average product quite as large as in Austria.

Thus it appears that a branch of industry now highly successful, began only under the protection of government, and with the aid of its fostering bounties struggled against difficulties with no very flattering success for many years. Others may commence with the benefit of the skill and experience so costly to them in its acquisition.

That the beet is destined to produce a large proportion of the sugar used in the United States, I entertain no doubt. Whether New England will be able to compete successfully with the prairie States in its production, is more doubtful; and yet the beet grows well here; probably quite as well as in Russia, where it is extensively grown for sugar.

Not much success can be expected from making sugar from beets in small quantities. Experience abroad has shown that nearly every factory which used less than two thousand tons of roots, has, one after another, given up the business.

While, therefore, we may not urge the trial of experiments in the manufacture of beet sugar in a small way, we can and do recommend a larger culture of the beet as a root crop for feeding to stock. This can be done with no danger of loss from the failure of doubtful projects, but with positive benefit to our herds from a more plentiful supply of succulent food. At the same time we may incidentally learn more than is now known among us regarding the necessary amount of labor or manure required, the average yield, and the cost of production per acre and per bushel. With these data in hand, in connection with the accumulated results of experience of other parties in the manufacture of sugar from the root, it will be comparatively easy to arrive at satisfactory and reliable conclusions regarding probable profit from the manufacture of beet sugar in New England.

It may be well to state that the "*White Silesian*" is the variety almost universally used for the production of sugar, as it yields a larger percentage than any other.

The beet succeeds best in a mellow loam, which should be deeply worked in order to enable the root to draw heavily upon the subsoil for nutriment and also to insure moisture in dry seasons. It is an ameliorating rather than an exhausting crop, as it receives most of its support from the air, and returns largely to the soil in manure, for even when used in the production of sugar, the pulp remaining is consumed by cattle.

In view of the fact that the Mangold is becoming a favorite root with many farmers, producing largely, it might be well to sow a portion of the plot prepared with this, as well as with the White Silesian, thus enabling the cultivator to form an accurate judgment regarding the comparative cost of production and the feeding value of each.

ON CHICORY AS A SUBSTITUTE FOR COFFEE.

Another article of daily consumption for which a considerable sum in gold is annually sent out of the country is coffee. Our climate forbids the growth of this plant, and unless we do without it the gold will continue to go. At present, numerous substitutes are extensively used in its stead. Undoubtedly a very large proportion of what is vended by grocers as roasted and ground coffee contains hardly a homœopathic sprinkling of the genuine article. These compounds consist, for the most part, of peas and beans,* rye and barley, in varying proportions, and are often mixed with other ingredients. A chief object of the manufacturers seem to be so to blend the flavor of the ingredients that no one shall present a recognizable and particularly disagreeable predominance over the others.

These mixtures are sold under various fancy names, more attractive than descriptive, and rarely so suggestive of the actual composition as one noticed in a western city labelled "Ry! O Coffee."

If substitutes are to be used, it is preferable to use the best, and especially since it can be grown by every farmer, or by any one who has a garden, as easily as any other vegetable.

Many years ago Von Thaer wrote as follows:—"Of all the plants which have been proposed as substitutes for coffee, and which when roasted and steeped in boiling water yield an infusion resembling coffee, chicory is the only one which has maintained its ground. It has been used (in Germany) in this manner for thirty years, even when the price of coffee has been low, and has always yielded considerable profit both to manufacturers who prepare it in large quantities, and to those who cultivate it." Since this was written by that eminent agriculturist, the consumption of chicory has increased in Europe many hundred fold, and it is now extensively grown for export to this and to other countries. Regarding its healthfulness as a beverage we express no opinion, and only remark that widely differing views have been held on this point, as is well known to be the case with regard to both tea and coffee also. The verdict of the masses is also equally well known. It may be stated that at one time it was believed abroad that the use of chicory diminished the revenue from duties on imported coffee, but it afterwards appeared that the prohibition of chicory lessened instead of increased the import of colonial coffee; and that the latter, and especially the green coffees, were generally believed to be materially improved in flavor by an addition of a third or a half of chicory.

---

* The plant grown in some sections under the name of coffe is merely a variety of the English bean, and differs from the Hone beans, Windsor beans, &c., so extensively grown in England for the use of stock, mainly in the size and form of the seed.

Chicory is a perennial plant found wild in various parts of Europe, and is sometimes seen among us as a weed bearing a star shaped blue flower, doubtless introduced from abroad, like numerous other weeds. It has a root like a carrot, and is of the easiest culture in almost any soils of moderate fertility, succeeding best in those of a loamy character and a little inclining to clay, dry, deep and rich. The mode of culture may be the same as for the carrot. A fair crop in Europe is considered to be from one and a quarter to one and a half tons of (dried) roots to the acre.

We gather some facts from the *Annales de Chimie*, as follows: The manufacture of a factitious coffee from the roasted root of the chicory appears to have originated in Holland, where it has been practised for more than a century. It remained secret until 1801, when it was introduced into France by M. Orban of Liege and M. Giraud of Korning, a short distance from Valenciennes. The manufacture of chicory-coffee, however, remained stationary for a long time and of no great importance, but for the last thirty years it has extended considerably, and has become an object of commerce of great importance. Manufactories have sprung up in several localities, especially at Arras, Cambray, Lille, Pais, Seulis in Normandy, Brittany on the continent, and also in England. Although grown to a great extent in England, large quantities of dry chicory have been imported from France into England, and its cultivation has become a source of great prosperity.

The plant requires a deep soil, of good quality and well prepared; the seed is sown in May and the harvest takes place in October. Some time before digging the roots, the leaves are mowed and fed to cows.*

---

* Chicory was formerly used in England extensively as a forage plant. Its leaves given alone communicate a disagreeable flavor to the milk, but in connection with other plants it forms an excellent fodder.

The roots are cut at first longitudinally and then transversely, in pieces from two to three inches in size—they are then carried into the drying chambers or kilns, and placed in layers of about a foot deep and frequently stirred to facilitate drying and prevent burning. Three or four such operations are performed every twenty-four hours. The roots thus dried are called cossétes. They may be kept in granaries; but are usually sold at once to the manufacturers, who roast them according to the demand.

When the roasting is nearly complete, two per cent. of butter is added and a couple of turns given to the roasting machine. This addition is made in order to impart lustre to the chicory and to give it the appearance of roasted coffee. It is then empted into iron vessels, and after cooling is crushed in vertical stone mills or between iron cylinders; it is then sifted, and during this operation a small quantity of reddish coloring substance (*rouge brun de Prusse*) is added to give it the color of coffee. The product is then weighed off, and sold in packets under a variety of names, but very rarely under its own; for instance, among others, Mocha Powder, Ladies' Coffee, Cream of Mocha, Pectoral Coffee, Chinese Coffee, Polka Coffee, &c., &c.

We have above stated that it forms an important article of commerce, above 12,000,000 pounds being consumed in France and a large quantity is exported. It appears from the tables of commerce in France that from 1827 to 1838 there were exported 458,791 kilogrammes of chicory-coffee of the value of 321,282 francs, and since that period the amount has vastly increased.

The seed can be obtained at any of the regular seed stores in our cities or principal towns, and any one who desires to buy it, can readily procure an ounce or more—enough for one family—at very small cost.

ON REGULATING THE SEX OF THE OFFSPRING OF ANIMALS.

[From the Journal of the Royal Agricultural Society of England, 1864.]

If there be any device for regulating the sex of the offspring of our flocks and herds, every breeder is interested in knowing it; even if a hint can be given which only improves his chance, without costing much trouble, it is still a boon.

It would seem from the following testimonial that Professor Thury of Geneva had got some insight into one of the factors which enter into this complicated and mysterious problem.

"I, G. Cornaz, manager of the property of my deceased father, M. A. Cornaz, late President of the Agricultural Society of Roman Switzerland at Montet, Canton de Vaud, hereby certify that I received from M. Trury, Feb. 18, 1861, a paper containing confidential instructions for the purpose of making a practical experiment to ascertain the law which regulates the sex of the offspring of animals.

I have applied these directions to my herd of cows, and obtained at once, without any tentative trial, the desired results.

In the first instance, in twenty-two successive cases, I endeavored to obtain heifer calves. My cows were Swiss, and my bull a pure Durham. Heifer calves were, therefore, in request—bull calves being only fit for the butcher; *in every instance I obtained the desired result.* Later, when I had bought a pure-bred Durham cow, I was anxious to breed a bull to take the place of the one which I had bought at so large a price. Again I acted according to Professor Thury's directions, which are ready of application, and again I was successful. Besides my Durham bull, I designedly bred six half-bred oxen for the plough from cows selected for their color and size. My herd comprised forty cows of all ages.

On the whole I have tried the new directions twenty-nine times, and in each case obtained the desired result, male or female; I have had no instance of failure. I personally watched each trial. I can consequently declare that I consider Professor Thury's system to be real and certain, and I hope that all breeders will specially profit by it.

Drawn up at Montet, Feb. 10, 1863.
(Signed) G. Cornaz."

We may learn from a pamphlet of Professor Thury, "On the Law which Regulates the Sex of Plants and Animals," what is his scientific theory, and what are the practical directions which he deduces from it.

The following statement is a brief summary of his views. Starting with the vegetable kingdom, Professor Thury adopts the theory of Knight, who, in concert with Wolff, De Candolle and Robert Brown, considered stamens and pistils to be fundamentally identical (both being modifications of the leaf), and further regarded the production of the male organ in plants as due to greater maturity or more perfect development.

Considering how general the laws of Nature are, the Professor infers that the propagation of animals follows an analogous course. He states that it has already been admitted that for certain oviparous animals the last hatchings produce males; that Huber recognized as fact that early fecundation produces female bees, and *vice versa;* and so from one step to another he arrives at the conclusion that an egg yet unimpregnated is female during the first part of its passage down to the matrix, and male in the last part. The sex, then, of the creature will depend on the degree to which the egg is matured at the moment of fecundation. He therefore considers it to be a general law that fecundation which follows shortly after "heat" or menstruation breeds female offspring, and *vice versa.*

The following are his directions and cautions:

1. The peculiarities of different cows should be observed and taken into account. The number of hours during which they take the bull varies from 24 to 48. To obtain a heifer, the first part of this period is to be selected; for a bull calf, the latter part.

2. Exceptional animals, such as are fat or tied up, afford no fair criterion; but healthy, well conditioned specimens, living in the open air should be selected for experiment.

These views should be taken for what they are worth. So far as the result depends on the mother; and she is a fair representative of her sex, the hint may, very probably, be serviceable; but that the sex of offspring is quite independent of the sire, as is here assumed, is a doctrine which, with some, will not pass unchallenged.

It is very desirable that the principles enunciated above be properly tested on a sufficiently large scale, and by reliable persons, who would themselves take care that the advice given should be correctly followed. The results of a few years experience would then enable us to determine whether Mr. Thury's deductions are valid as a law.

To the Legislature of Maine:

The undersigned, Commissioners appointed under the "Resolve relating to the establishment of a college for the benefit of agriculture and the mechanic arts," approved March 25, 1864, submit the following

REPORT:

The act of Congress, approved July 2, 1862, a copy of which is appended to this Report, donated to this State, conditionally, two hundred and ten thousand acres of land. One of the conditions annexed to the donation is that "no State shall be entitled to the benefits of this act unless it shall express its acceptance thereof by its Legislature within two years from the date of its approval by the President." This condition was complied with by this State by resolve of the Legislature, approved March 25, 1863; information of the fact was communicated to the Department at Washington, and thereupon the scrip for the number of acres before named was issued and forwarded to the Executive of the State, in whose possession it still remains.

In 1863, March 25, the Legislature provided by resolve for the election of thirteen persons, to be chosen by the Legislature then in session, in joint convention, who were to constitute a Board of Regents of such college or institution as should thereafter be established under the provisions of the act of Congress before referred to. The Legislature adjourned without holding the election provided for by the resolve, and, therefore, it has now no force.

In 1864, March 24, the Governor was empowered by resolve to make sale of the land scrip before referred to, but in making such sale he was required to "act in concert with the Governors of the other States." The authority to sell conferred by this resolve has never been exercised, the concert of action contemplated having become, from various causes, impracticable. The scrip cannot be sold, therefore, under any existing legislation, nor until the Legislature confers on some one authority to make the sale.

On the day following, March 25, the resolve providing for this

Commission was passed, and the undersigned were subsequently appointed the Commissioners.

Such is a brief history of the legislation in this State in relation to the donation of lands by Congress for the purpose specified in the act of July 2, 1862.

MEMORIAL TO CONGRESS. The act of Congress provides that any State which may claim and take the benefit of its provisions, shall provide, *within five years*, at least not less than one college, as described in the fourth section of the act, or the grant to such State shall cease. Whether that term commenced at the date of the act, July 2, 1862, or at the date of the resolve accepting the donation, March 25, 1863, may be questionable. The resolve under which we act authorized us to "memorialize Congress for an extension of the term during which the college for the benefit of agriculture and the mechanic acts may be provided." We have not so done, because the last session of Congress was so near its close when we entered on the performance of our duties that we could not hope for any action on our memorial before its adjournment, and we have not presented any such memorial to Congress now in session because we believe your action will render it unnecessary. If our anticipations in this particular are not realized, ample time yet remains for the performance of this duty by us or by some other duly constituted authority.

ACTION OF OTHER STATES. It is made a part of our duty to confer with the authorities of other States engaged in the same enterprise; the object being, probably, to ascertain what they had done, were doing, and were proposing to do. This duty we have performed, so far as lay in our power, by correspondence, and by personal interview with gentlemen in Massachusetts who have the subject matter in charge; and have to report, that in most of the States where the donation has been accepted no further action has been had than in our own; they seem to have been, like ourselves, awaiting the further action of States in which the initiatory movement towards the establishment of the contemplated institution has been made.

In MASSACHUSETTS, the Legislature has appropriated nearly one third of the interest on the fund derivable from the sale of the land scrip to the "Institute of Technology," practically to the promotion of the mechanic arts; the balance to the "Massachusetts Agricultural College:" an institution established more especially for instruction in branches related to agriculture, and located in the vicinity of Amherst College.

The amount of the land scrip held by that State is for 824,000 acres; of that, 100,000 acres were put in the market in June last, and one third of that amount sold for eighty-five cents per acre; of the amount sold recently we are not informed.

In New York, the income derivable from the fund has been appropriated by act of Legislature for the endowment of the "Peoples' College," an institution chartered several years ago for the avowed purpose of affording instruction in agriculture and the mechanic arts.

The price of the scrip in that State has been fixed at eighty-five cents per acre, and has never varied from that rate. Up to October last sales had been made to the amount of over sixty thousand dollars.

In New Jersey, the income of the fund has been appropriated, by act of Legislature, to the endowment of a department, in which the instruction shall be in conformity to the requirements of the act of Congress, in "Rutger's College."

The sale of the scrip is confided to a Board of Managers, who have not yet, unless very recently, determined the price at which to sell.

In Connecticut, the income of the fund has been appropriated, by act of Legislature, to the maintenance and support of "such courses of instruction as shall carry out the intent of the act of Congress," in that department of Yale College known as the "Sheffield Scientific School." The act of Legislature referred to provides the number and the mode in which the pupils to be admitted and instructed, gratuitously, shall be selected.

The land scrip of this State was for 180,000 acres, and has been sold for $135,000. The whole amount has been invested in bonds of the United States.

In Vermont, the attempt has been made by legislative action to incorporate the three existing colleges with a new corporation, under the name of the "Vermont State University and Associate Colleges," the income arising from interest upon the fund derived from the sale of the land scrip to be appropriated to the support of the new organization; conditioned that such new organization shall at all times maintain a regular course of instruction which shall conform to the requirements of the act of Congress.

Whether the attempt has been successful, we are not informed; in our opinion, it is not material that we or you should be. We all know that in our State any such combination, involving the extinction of the individuality of our numerous literary institutions, would be impracticable.

We learn that more than one-half of the land scrip of this State was sold some time ago; a portion at eighty cents per acre, and the remainder at eighty-two. The proceeds were invested in bonds of the State.

In NEW HAMPSHIRE, under a resolve similar in purpose to the one under which we are acting, a Committee has been appointed, with authority to "prepare a scheme for the establishment of a college for education in Agriculture and the Mechanic Arts." We hope to procure a copy of the report of that Committee in season to present it to you or your Committee who may have the matter in charge, before your final action in the premises.

No sale of the scrip belonging to this State had been effected, nor, as we are informed, had any effort been made to effect a sale up to October 17th, ult.

In MICHIGAN, The State which has heretofore done more to promote agricultural education than any other State in the Union, the income arising from the fund has been appropriated, by act of Legislature, to the support of the "State Agricultural College," an institution which has existed since February 14, 1855, and was originally established in compliance with the requirements of the Constitution of the State, that "the Legislature shall encourage the promotion of intellectual, scientific and agricultural improvement; and shall, as soon as practicable, provide for the estalishment of an agricultural school." In making the appropriation, however, the Legislature required that military tactics and engineering should be added to the course of instruction already provided by law.

A portion of the lands subject to location under the Act of Congress are within the limits of this State. The necessary measures have been taken by the duly constituted authorities to select such lands. Whether sales have been effected to any great extent, or at what price, we cannot report; but the *minimum* price fixed by the Legislature is two dollars and fifty cents per acre.

This is the extent to which we can go in communicating information as to the action of other States, excepting in those which have evinced no more energetic enterprize than we have in our own; their action has been the counterpart of ours.

You will perceive that no one of the States enumerated, with the exception of Massachusetts, has thus far provided, on an independent basis, an institution or college, such as is contemplated by the act of Congress, Sec. 4. That in all the cases where an appropriation of the income to be derived from the donation has been made, it has been to sustain some existing institution which was able and willing to assume the obligation to maintain such course of instruction as is required by the act making the donation. The obvious reason for adopting this course will be made apparent in another part of this report.

Proposed locations, their advantages, &c. It is made a part of our duty to "invite and receive donations and benefactions in aid of said college, and also proposals for the location thereof; to visit and examine all such proposed locations, when so directed by the Governor and Council, to consider the respective advantages of such locations, and to entertain all propositions which may be made for that purpose."

This part of our duty we have discharged by advertisements in the public press, calling the attention of the public to the subject, inviting donations and benefactions, and by visiting and thoroughly examining the locations proposed, three in number, all tendered to the State for the benefit of the proposed college.

In the month of September last, by invitation of Benjamin F. Nourse, Esq., a native of this State, but now residing in the city of Boston, we visited and examined a farm belonging to him at Goodale's Corner, in Orrington, the fact that he was willing to offer it as a gift to the State for the benefit of the proposed College, if the Commissioners should encourage it by their favorable opinion, having been previously communicated to one of our Commission. The examination of the premises impressed us so favorably, taking into consideration their pecuniary value and peculiar adaptation to meet the requirements of a model or experimental farm, that we invited Mr. Nourse to submit his proposition in writing, which he accordingly did, and which we embody in our Report, premising that the description of the premises contained in it is in every particular correct.

BOSTON, September 5, 1864.

To Messrs. W. G. Crosby, Samuel F. Perley and Joseph Eaton, *Commissioners:*

GENTLEMEN:—I now formally tender to the State of Maine, through you, the free and unconditional gift of my farm at Goodale's Corner, Orrington, as a site for the proposed State Agricultural College—the offer of which was implied by my invitation to you for your recent visit and inspection of the property.

The area of the farm is about 425 acres. Its westerly line bounding on the highway known as the "the back road" from Bangor to Bucksport; its easterly line runs on the margin of Brewer's Pond for about three-quarters of a mile; its northerly and southerly lines bounded by lands of other proprietors. Its distance from Bangor is between seven and eight miles.

It consists of two principal portions—the home farm of about 200 acres, and of wood lots and burnt lots about 225 acres; or as specifically divided of

72	acres	plowed land and mowing fields,
78	do	of pasture,
1½	do	in apple orchard,
1½	do	in new pear and apple orchard,
10	do	in muck and peat bed,
137	do	in wood land, mostly young growth, and
125	do	of rocky land, of little value, much of it recently burnt over.

Of buildings there are:

A new and commodious house of 11 rooms, with wood-house and wagon-house attached;

A new barn, 42 by 60 feet, having an eight-feet basement story fitted throughout with cattle stalls, which leaves the whole capacity of the barn above for storage of hay, grain, &c.;

An old barn, in good condition, 36 by 44 feet, beneath which is a deep manure cellar;

A small building for storage of tools, &c., having projecting sheds for wagons and carts on one side, on the other for cattle shelter;

A piggery (new) about 18 by 30 feet; and

A sheep shed (old) of good capacity.

Among the improvements of a more permanent character are, 2916 rods, or 9 miles and 36 rods, of covered drains, 3, 3½ and 4 feet deep, of which about three-fourths were laid with tile and one-fourth with stone—all believed to be in good order.

400 rods, or 1¼ miles, of substantial stone wall.

800 rods, or 2½ miles, of rail fence, of which one-half is new, or nearly new; (only half the outside or boundary fences included,)

270 rods of good, smooth farm roads.

4 wells of good water.

An apple orchard of 100 trees, the greater part mature, bearing trees, many of which are feeble and decaying.

A new pear and apple orchard, in healthy, thrifty condition, of
84 apple trees,
202 pear trees, set in orchard rows, and
68 do do reserved in nursery row.

354 trees in this orchard, of which about 70 are bearing this season.

In other places on the farm are about 100 good pear and apple trees—a total of 550 fruit trees.

A grape trellis of 18 rods, has 24 vines of such sorts as Hartford Prolific, Concord, Delaware, Isabella, Rebecca, &c., of which half have borne and ripened well good crops.

There is a fair supply of farm implements—plows in variety, harrows, cultivators, seed-sowers, roller, mowing-machine, horse-rake, hay-cutters, carts, wagons, and the many other tools required for ordinary farm work.

You, gentlemen of the Commission, have seen the premises, and know the character of soil, the merits and defects of the whole estate.

Such as it is, with its buildings and other improvements, and its farm implements, I freely offer to my native State, if it shall be found acceptable for the purposes of the proposed College.

It is to be supposed that many other farms will be offered for this purpose, and among them some more favorably situated, if not more valuable or better adapted than mine. Should it be so, let me ask of your courtesy to let me know that mine will not be accepted as soon as it shall be apparent, that arrangements for the ensuing season may not be too long suspended. While, if my farm shall be acceptable, it will give me great pleasure to execute the deeds for its tranfer.

I remain, gentlemen, with great respect,
Your obedient servant,
B. F. NOURSE.

We have remarked that an examination of the premises produced and left on our minds a favorable impression. If the perusal of the foregoing truthful description of them does not produce the same effect on the *legislative mind*, we shall distrust our own judgment, or accept the doctrine that a Legislature is something less than *human*.

The advantages of this location, we think, are obvious; perhaps isadvantages are equally so.

It is desirable that the location of an institution designed more especially for the benefit of the industrial classes—the people—should be at a point which all can reach, in the ordinary modes of travelling, at comparatively small cost; in other words, at some central point, some point to which the great thoroughfares of travel converge. The farm at Goodale's Corner fails to meet this requirement.

There is one other disadvantage attending this location, as well as the one we shall next consider: the want of buildings necessary for the operations of the institution; rooms for recitations and lectures; for a chemical laboratory, a geological and mineralogical cabinet, a library, and various other purposes. The population in the vicinity is sparse, and adequate provision for the board and lodging of pupils could be made only by the erection and furnishing of buildings for that specific purpose. The dwelling-house on the premises, beautiful as it is in its architecture, and as nearly perfect as it well can be in its construction, can be of service only as the residence of the President or Professor; the associate teachers and the pupils remain to be provided for.

This provision must come from one of two sources—the State or individuals; for the act of Congress provides expressly that "no portion of said fund, nor the interest thereon, shall be applied, directly or indirectly, under any pretence whatever, to the purchase, erection, preservation or repair of any building or buildings."

No individual has offered to donate the money required for the erection and furnishing of necessary buildings; we cannot recommend that, in the present pecuniary crisis, the State should do so; funds for this purpose from both sources failing, it becomes most manifest that the location for the institution must be where the buildings required for its operations can be furnished gratuitously, at least until the means for defraying the expense of their construction can be derived from some source other than the donation from the General Government.

We next visited the premises in Gorham tendered to the State by Hon. F. O. J. Smith. The character of the premises and the advantages of the location are accurately set forth in his communication to the Governor, a copy of which we subjoin.

NEW YORK CITY, Feb. 8, 1864.

To His Excellency Samuel Cony, Governor of Maine:

SIR:—I am owner in fee of a well known farm in Gorham, county of Cumberland, nine miles from the city of Portland, accessible by railroad several times daily, and the same now occupied by Col. J. J. Speed.

It consists of a fraction rising ninety acres, of which about one fifth is in woodland and pasture, and four fifths of tillage, without a rod of waste land in the four fifths, under proper cultivation.

It has upon it a small farm house and barn of inconsiderable value. But it has a mansion house and stable, the former of commodious size, built of the best material and in the most workmanlike manner, and of great architectural beauty. It is in good condition of repair, and upon a site of unsurpassed natural as well as artificial beauty. It is within three fourths of a mile of the State Female Seminary in Gorham village, and a like distance of the York and Cumberland Railroad depot. It cost a former owner, as I am well informed, upwards of thirty thousand dollars.

I propose to donate this entire property to the State with a perfect title, on the single condition that the State will locate and sustain upon it permanently the Primary Agricultural College which it has undertaken to establish under the munificent grant of lands by the government of the United States.

I speak of a primary college, as I believe it will be found wise and advantageous to the State, in the future, and more satisfactory to the people, to distribute portions of the funds that will be derivable from the federal grant, if judiciously handled, to different localities and branch schools of instruction in the State, in order better to secure the diversity and extent of territory and soil requisite to develope and reduce to practical illustration and popular instruction the varied departments of agricultural science and its adjunctive arts. The scattered population of the State will also be doubtless better accommodated by this distributive system. Cattle and sheep husbandry and horse breeding, for instance, require a far greater extent of territory, and a very different soil, from that best suited to the cereal products, and grasses and root culture.

So, theoretical instruction—lecturing tutors and consulting managers—of a State system for diffusing agricultural knowledge for subsequent or cotemporaneous reduction to practice, as well as an accumulating State library, and perhaps, in time, a zoölogical garden and a museum of natural history, may each well have a location different and even distant from the auxiliary branches of a State system, where practical agencies will be the peculiar characteristic of their selection and uses.

However, be this as it may, and I defer all to the ultimate decision of those to whom is properly entrusted the responsibility of the subject, I tender to the State the above donation of a property I believe to be preeminently suited in beauty and salubrity of location, in proximity to the commercial capital of the State, in accessibility by railroads and county roads, and in ready adaptability to the ends in view, coupled only with the one condition above expressed.

I will venture to add, that if accepted, it will afford the State an immediate nucleus for starting the great beneficent scheme of the Federal Government for popular instruction in the noblest of human employments, without affiliation with any existing creations of a sectarian character, and with a fair prospect therein of maintaining it in like exemption forever—a result which cannot be too cautiously fostered to insure permanent and undisturbed success, and the enduring good will of all truly catholic minds.

Your Excellency is at liberty to make such use of this communication as may in your judgment be most judicious for definite action at an early day.

With sentiments of great respect,
Your obedient servant,
FRANCIS O. J. SMITH.

This location labors under the same disadvantage as that at Goodale's corner, namely, the lack of necessary buildings, although not to so great extent. It is but a short distance, about three fourths of a mile, from the village in Gorham, where pupils could readily be provided with board and lodging; but the buildings necessary for conducting the operations of the institution, such as have been before enumerated, would still be wanting.

These two locations are all that have been offered to the State gratuitously and unconditionally. Whether accepted or not, the thanks of the people of the State are due to the gentlemen making the several offers for their noble and disinterested generosity.

The only other proposed location visited is in Brunswick, and is tendered to the State conditionally; on what condition fully appears in the following communication from President Woods of Bowdoin College:

WHEREAS, the President and Trustees of Bowdoin College have received, from bequests made by the late Josiah Little, Esq., (in 1860), a fund of the estimated value of twelve thousand dollars, and hold the same in trust for the purpose of "aiding in the establishment and support of an institution to teach the principles of science appertaining to agriculture and the mechanic arts," and have already made some provision for such instruction to be given to such students as might offer, by the appointment of a professor, to be supported in part by the income of this fund.

And whereas, the State of Maine has received, by Act of Congress, July 2, 1862, certain land scrip of the estimated value of two hundred thousand dollars for the endowment, under certain conditions, of an institution "to teach such branches of learning as are related to agriculture and the mechanic arts."

And whereas, it is believed that the common object had in view in these separate benefactions may be best promoted by an united agency.

Now, therefore, it is proposed that the said land scrip shall be transferred and assigned by said State to said Corporation in trust for the objects and on the conditions prescribed.

And, on said transfer and assignment being made, said Corporation hereby engages to establish an institution, separate and distinct from any and all others, for the sole object specified in the fund and the grant above mentioned, to enact laws and statutes for its government, and to make all the appointments and arrangements necessary to put this institution in operation within the time limited by said Act of Congress, and in general to perform, without involving any expense to the State, all the obligations assumed by it in accepting said grant, and all those imposed on any institution which may be established under its provisions.

More particularly said Corporation engages on the condition aforesaid:

I. To keep all monies derived from the sale of said land scrip separate from any and all other monies of which it may be possessed; to invest them in suitable stocks yielding not less than five per cent. upon their par value; to take care that the capital fund shall remain forever undiminished, (unless it should be thought best to expend ten per cent. of it in the purchase of sites or experimental farms;) to give satisfactory guarantees to indemnify the State against any unauthorized diminution or culpable loss of said capital fund, and to employ the whole income, adding thereto the income of the fund above mentioned, for the object above specified, and for no other object whatever.

II. To appoint a Faculty, which shall constitute the Executive Government of the Institution, and have intrusted to it the general management of its affairs, which shall have authority to enact such rules and regulations, in addition to the statutes and laws enacted by the Corporation, as they may judge necessary to secure the best order and strictest discipline, and which shall also have authority to elect a Dean or Secretary, whose duty it shall be to keep a careful record of their proceedings, and to act as their agent; said Faculty to be distinct from and independent of any and all other faculties, and shall consist of the President of the Corporation, the Professors (and Lecturers) of the Institution, one member from the Trustees and two from the Overseers of the College; the Secretary of the Board of Agriculture, the Superintendent of Common Schools, and the Adjutant-General of the State, *ex officio*, or of any three to be nominated annually by the Governor and Council.

III. To appoint and support by adequate salaries not less than   Professors or Lecturers, including among these the Josiah Little Professor of Natural Science, to be selected impartially with sole reference to their qualifications for their office, whose duty it shall be, at such times and in such order as may be determined by the Faculty, to give courses of instruction, which, until otherwise ordered, shall be completed within one year, in the following branches of study, viz.: 1. Vegetable Physiology and Botany; 2. Comparative Anatomy, Physiology and Zoology; 3. Stock-breeding, Veterinary Surgery and Pharmacy; 4. General, Practical and Technical Chemistry; 5. Mineralogy, Geology, Mining, &c.; 6. Physics, (Acoustics, Optics, Heat, Electricity, &c.); 7. Practical Mechanics, (Constructions, Machines, Architecture); 8.

Entomology; 9. Military Tactics, (Infantry and Artillery Tactics, Use of Small Arms, Theory of Ordnance and Gunnery, Science of War); 10. Mathematics and Engineering; 11. "Other Scientific and Classical Studies," (History, Philosophy, Political Economy, Constitution of the United States and of State of Maine, English Literature and Modern Languages,) such as it may be expedient from time to time to add to the more strictly practical studies before mentioned, to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life.

IV. To admit to this Institution, and to any or all of these courses of instruction, such students as may be nominated from the several representative districts in the ratio of the representation, and such others as may apply, the whole number not to exceed until otherwise ordered; such students, unless they come from another State, to be subject to no charge for tuition, and to no fees whatever, except five dollars on matriculation and three dollars on graduation, for the incidental expenses; to be not under eighteen years of age; to pass examination, in order to admission, in the common branches of English education, and such other studies as may be prescribed from time to time, and may be found necessary to qualify them to pursue with advantage the courses to which they propose to give their attention; to be subject to all the laws and regulations which may be enacted by the Corporation or the Faculty, and to be entitled, after attending on the instructions of the Institution for one year, and having passed a satisfactory public examination in one or more of the departments, to receive the degree of Bachelor of Science, and a diploma bearing the signatures of the President and the Faculty, and specifying the department in which they had been examined, and their grade of merit; or in case they have not attended through a whole year, to receive a certificate, stating the time they have been present, the studies pursued, and the progress made.

V. To provide the necessary philosophical and chemical apparatus, cabinets of specimens in geology, botany, mineralogy and comparative anatomy, and a museum of natural objects, appropriating for this purpose the sum of one thousand dollars a year for years, and afterwards the sum of annually, and at the same time to allow the apparatus and collections already belonging to the College to be used in the instruction of the students of the Scientific Institution.

VI. To provide for the Institution a library, to consist of books and periodicals relating to agriculture and the mechanic arts, appropriating for this object one thousand dollars a year for
years, and afterwards the sum of
annually, and at the same time to give to the students of the Scientific Institution the use, under certain conditions, of the public libraries of the College, it being understood that this library shall also be open to the use, under certain conditions, of citizens of the State at large engaged in agricultural and mechanical pursuits.

VII. To provide a building, to be erected by the College within such time as may be agreed upon, and without drawing in any manner, or under any pretext, upon either the capital or the income of the original fund; to be equal in style and similar in plan to the Maine Medical College; to be appropriated to the objects and uses of the Scientific Institution, and known by such name as may be given to this Institution; to contain lecture-rooms for all the courses of study not otherwise provided for, and also rooms for the library, cabinets and museum; and until such building can be erected, to set apart, for the uses of the Institution, such College buildings, or portions of them, as shall furnish it with ample accommodations.

VIII. To provide land for an experimental farm, and for a botanical garden, to be under the direction of a Superintendent, in which students may employ themselves, at their option, in manual labor, and may see the results of different methods of culture, provided, however, that they shall be encouraged to make such experiments on their own farms at home, and shall be expected to report the results to the Superintendent.

IX. To provide a gymnasium and a Campus for military drill.

X. To make an annual report to the Governor and Council, and to other schools established by the national grant, representing the condition of the Institution, the investment, income and expenditure of the funds, the Professors employed, the salaries paid and instructions given, the number of students admitted and graduated, and to hold themselves subject, in their administration of the affairs of the Institution, to such visitation, stated or occasional, as may be directed by the Legislature; provided, that should the fund fall short of the estimated value, the Corporation shall be proportionately relieved from the obligations here assumed.

LEONARD WOODS,
in behalf of the Committee.

This location is nearer the centre of population than either of the other two, and is accessible by railroad daily from the east and west. The tract of land referred to as the site for an experimental farm embraces about three hundred acres; the soil is well adapted to the cereal products and root culture; presents the ordinary diversity to be found in a territory of the same extent in our State, and combines all the elements desirable in a farm for experimental culture, but is not suitable for a stock farm.

That you may have full knowledge and the benefit of all the methods suggested to us for the appropriation of the income of the fund derivable from the sale of the land scrip, we present to you, in this connection, a plan proposed by President Champlin of Waterville College. The plan in all its details appears in the following draft of a bill prepared by him:

AN ACT establishing an Industrial College under the act of Congress donating public lands to the several states and territories for the benefit of agriculture and the mechanic arts.

SECTION 1. *Be it enacted, &c.,* That the Governor, the Attorney General, the Secretary and the Treasurer of the State, together with the Superintendent of Common Schools and the Secretary of the Board of Agriculture (or should any of these offices be abolished, then the vacancies to be filled by the Legislature), be, and hereby are, constituted a body corporate and politic, under the name and style of the "Board of Trustees of the Maine Industrial College;" of which body the Governor shall be the President, and the Secretary of the Board of Agriculture and the Treasurer of the State, the Secretary and Treasurer, and that meetings of this board—at which a majority shall always be necessary to constitute a quorum—may at any time be called by the Governor, by mailing to each of the other members, at his usual place of residence, a written or printed notice, stating the place, time and object of the meeting, at least ten days before the same is to take place.

SECT. 2. *And be it further enacted, &c.,* That the above-named board be, and hereby are, authorized and directed to sell, as soon as may be after the passage of this act, through suitable agencies in the cities of Boston and New York, the land scrip issued to this State by the United States for the benefit of agriculture and the mechanic arts, and invest the proceeds of the same in stocks—which the State hereby guarantees shall produce an interest of not less than five per cent.—and deposit these stocks for safe keeping with the Treasurer of the State. And of these sales and transactions they shall make a report to the next Legislature of this State and also to Congress.

SECT. 3. *And be it further enacted, &c.,* That the said board be authorized and required to establish in Bowdoin College a professorship of chemistry applied to agriculture and the arts, in Waterville College a professorship of civil and rural engineering, or of mathematics applied to the mechanic and other practical arts, and in Bates College a professorship of agricultural zoölogy and veterinary science, including the anatomy, physiology and pathology of animals; these professorships to be established in the above-named institutions on the following conditions, to wit:

1. That the particular branches to be taught in these special departments shall be agreed upon between the boards of the Industrial College and of these institutions respectively, and be so arranged as to come as near as may be within the compass of a single year, and together with certain additional studies selected from the general studies of the college by the same parties, sufficient to occupy the time of a student for two years, shall be called the "Scientific Course" of the college; and those completing this course satisfactorily, or the studies of the above-named special departments in two of the colleges, shall be entitled to the degree of Bachelor of Science, while those completing the studies of but a single one of these departments, shall receive a degree suited to the nature of the case—for which degrees they shall pay the same fees as other students.

2. That it shall be the duty of the professors thus provided for to give instruction in the studies belonging to these special departments, and such other kindred studies in the Scientific Course as may be assigned them by the two boards above referred to; also to make to the Secretary of the Industrial College an annual report of the attendance on their instruction and of the general conduct of their departments, and to lecture in concert, during their winter vacations, and in conjunction with other lecturers, in a course of public lectures on agriculture and the mechanic arts. The pay for which services, as well as their appointments to their offices, shall be agreed upon between the boards of the Industrial College and of the institution where each is to serve.

3. That the said colleges shall make no charge for the instruc-

tion given these special students by the professors thus appointed, and allow them to pursue other studies belonging to their course and enjoy the general privileges of the institution, on the same terms as other students; and after paying the salaries of said professors from the annuities allowed them by the State, shall expend annually all that remains in materials, books, apparatus and other provisions for these special departments—which books, apparatus, &c., they shall hold in trust for the Trustees of the Industrial College, and deliver over to them, in case this arrangement should ever be brought to a close, as hereinafter provided for; that they shall teach gratuitously, to such of these special students as desire it, military tactics, and afford all the accommodation and facilities at their command to the course of lectures provided for in the last section of this act.

4. That the students in these several departments shall be subject to the same rules and regulations as to attendance on college exercises and general conduct and deportment as the other students in the institution.

SECT. 4. *And be it further enacted, &c.*, That, on receiving from the Trustees of each of the above-named institutions their assent to the foregoing conditions, the professors provided for above shall be appointed, and the said board shall authorize and direct the Treasurer of the State to pay over annually to the Treasurer of each of these institutions twenty-five per cent. of the income of the said stock deposited with him for safe keeping, *provided* such annual payments to each of these institutions shall in no case exceed the sum of two thousand dollars. And these annual payments to the aforesaid institutions shall be continued forever, unless the Supreme Court of the State, on complaint being made to them, shall decide that the foregoing conditions have been violated by either of the said colleges, in which case payment shall be withheld from that institution till it conforms to the conditions as interpreted by said court; *provided*, however, that at any time within three years after the first day of January, eighteen hundred and seventy-four, the Legislature may make a new disposition of the whole matter by repealing this act, or the colleges, or either of them, may withdraw their assent to the conditions.

SECT. 5. *And be it further enacted, &c.*, That the remainder of said income shall be expended under the direction of the board of the Industrial College, partly in paying expense of conducting experiments calculated to throw light upon doubtful problems in

American agriculture, and partly in employing additional lecturers for a course of public lectures on agriculture and the mechanic arts, to be delivered in rotation, sometime during the winter months, in Brunswick, in Waterville and in Lewiston—these lectures to embrace, besides the subjects included under the special departments provided for above, the applications of botany, meteorology, physical geography, entomology, geology, mineralogy, political and rural economy, &c., to agriculture, together with instruction on mining, theoretical and practical agriculture and horticulture, and other subjects interesting to farmers farmers and mechanics.

We are not inclined to recommend the adoption of the plan proposed in the foregoing bill for various reasons. We will state but two:

First. It makes no provision for the "*practical* education of the industrial classes in the several pursuits and professions in life," as the act requires. We believe that any system for the education of pupils in agriculture and the mechanic arts is imperfect which does not unite practice with theory; that pupils should be taught not only *what* to do theoretically, but *how* to do it practically. The student in surgery may become very learned in theory by attending courses of lectures, but it is the actual dissection of the *subject* which qualifies him for the practical discharge of the duties of his profession.

Second. As we construe the law, such an appropriation of the income derived from the sales of the scrip, as is proposed by the bill, would not be in accordance with the spirit of the act or the intention of its framers. It would not be the *endowment of a College where the leading object* would be such as is contemplated by the act. We do not see how under such an appropriation of the fund that provision of the act could be complied with, which requires that "an annual report shall be made regarding the progress of the College, *recording only improvements and experiments made, with their cost and results.*"

Recommendation of Commissioners. Having thus briefly presented to you the advantages and disadvantages of the several proposed locations, it may be expected, although it is not made part of our duty, that we should express our own opinion as to which one is the most eligible; which one it will be for the interest of the State to accept.

Assuming the market value of the lands donated to this State to be eighty-five cents per acre—the price established in New York —the highest price at which they have been sold in Massachusetts —we have as proceeds of sale of the 210,000 acres the sum of $178,500. That sum invested in stocks bearing five per cent. interest would yield an annual income of $8,925. We take five per cent. because that is the minimum rate fixed by the act of Congress, and because it is as large a rate of interest as can be anticipated in the *long run,* although for some ten or twenty years to come six per cent. might be realized. But adopting six per cent. as the rate of interest, the annual income from the fund would be only $10,710. That amount would be totally inadequate to support, on an independent basis, such an institution as is contemplated by the act of Congress. That act requires the maintenance of an institution of a higher grade than our academies and high schools ; "a college where the *leading* object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, . . . in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." Such an institution would require a corps of professors equal in number and acquirements to those employed in other New England colleges. To make it thoroughly efficient, it should be furnished with a chemical laboratory, an anatomical, mineralogical, and geological cabinet, and territory for an experimental farm, beside workshops, and the pecuniary means to keep the whole machinery in active motion. To do this the income from the fund as before estimated we believe to be utterly inadequate.

The land for an experimental farm has been generously tendered to the State ; but from what source is the money to come to pay the expense of erecting the buildings necessary ? It must come, as we have before said, from the State or from individual charity : the former we cannot advise ; we have no reason to hope for the latter. But even were this want supplied, the want of teachers, lecturers, material for demonstration in the various branches to be taught, and for operating the farm, still remains unsupplied. Every practical man, without resort to arithmetical calculations, will at once perceive that a larger income than our fund will yield will be required to meet that want.

It may be said that if the income from the fund is not sufficient to support a *college*, let it be appropriated to the support of an *academy* or a *high school*. Our reply is that such an institution would not come up to the expectations of the donating power, nor answer the requirements of the act; that its insignificance would deter those from attending for whose especial benefit it was the intention of government to provide; that but a few years would elapse before it would be calling on the State for aid; that its feebleness would constitute its strongest argument; that without that aid it would dwindle and finally perish.

We believe that the proposed institution should be sustained by the donation from government, and we are unwilling, as individuals, to become party to or indorse by our recommendation any arrangement which, by any possibility, can subject the State to loss, or impose on it any burthen or responsibility beyond that which it has voluntarily assumed in accepting the donation.

The question presents itself, Shall we reject the donation because instead of yielding an annual income of twenty-five or fifty thousand dollars it will yield ten thousand only for the education of our industrial classes? This question we answer in the negative, because the expenditure of even that sum only for the proposed object cannot fail to be productive of good results; not to so great extent as the expenditure of a larger sum, but yet to *some* extent. We should answer the question in the affirmative, if by the acceptance of the donation the State was to be committed, directly or indirectly, to the expenditure of its own moneys in furtherance of the object. Not because that object is not a laudable one, and one well worthy the fostering care of the State, but because the pecuniary burthens resting on the people in the present crisis are as heavy as they can well bear.

Assuming, then, that it is for the interest of the State to accept and retain the donation—that the probable income to be derived from it will be insufficient to sustain, on an independent basis, such an institution as the act of Congress contemplates in its broadest sense, and that it is impolitic to impose on the State the burthen of supplying the deficiency, we do not hesitate to recommend the acceptance, with certain modifications, of the proposition embraced in the foregoing communication from President Woods. In so doing we shall comply with the requirements of the act of Congress; we shall preserve the fund intact, as no portion of it will be required for the purchase of lands; we shall be spared the necessity of appealing to the State or to individuals for the funds required to erect buildings and purchase the apparatus necessary to make the institution practically useful to the people. Every necessity of that character will be at once promptly supplied under the proposition, and on the sale of our scrip and the investment of its proceeds, our Industrial College, or College of Agriculture and the Mechanic Arts, will be at once ready to enter on its career of usefulness.

It may be said that in adopting the proposed plan, we are simply establishing a department of agriculture and the mechanic arts in an existing institution. Admitting such to be the fact, we shall be doing what other States have done, and what they and we shall be justified in doing. We shall be doing *something*, and, under the circumstances, the most we can do with the fund for the benefit of the industrial classes.

But, in accepting the proposition, we do more than establish a department in Bowdoin College. We establish an institution on a basis of its own; we avail ourselves of the Josiah Little Fund, which that College holds in trust for the benefit of agriculture and the mechanic arts; we receive from the College the aid which can only be derived otherwise from the State or individuals.

It is true that the College may derive corresponding benefits from the accession of students, and the additional importance it may acquire from its local connection with the Industrial College; but the objection that a bounty bestowed blesses him who gives as well as him who receives, comes with an ill grace from the recipient of the bounty.

It may be objected that in adopting the plan proposed, the interests of the State are made subservient to those of the College; or, in other words, that the State will be thereby relinquishing to the College the entire management and control of the fund which Congress has intrusted to the State for the benefit of the people. This objection we would obviate by providing that the control and appropriation of that fund shall be confided to a Board of Trustees or Overseers, composed of the Governor of the State, the Adjutant General, the Attorney General, the State Treasurer, *ex officio*, and three others, to be selected from one or more of the industrial classes by the Governor and Council—seven in all, to represent the interests of the people, and of the President of Bowdoin College, three of its Professors, those whose departments of instruction are most intimately connected with the branches taught in the Industrial College, one of its Trustees and one of its Overseers—

six in all, to represent the interests of the College; thus providing, that in the event of any conflict of interest, real or imaginary, between the parties, the people, through their representatives, shall have the controlling vote.

The plan submitted by President Woods proposes that the scrip shall be assigned to the College. This, we think, cannot legally be done. The act of Congress contemplates that the scrip shall be converted into money, that money invested in stocks, and those stocks held by the State inviolate forever; a perpetual fund, "the capital of which shall remain forever undiminished," &c. The income derived from that investment, however, may be appropriated in such way and manner as the Legislature may direct, subject to the provisions contained in the act.

As the whole movement in the premises is experimental, it may be well to provide, in the event that such an arrangement is made with Bowdoin College as is recommended, that the arrangement may be terminated by either party at the expiration of a given term, say ten years; but the expediency of such a provision is submitted to the wisdom of the Legislature.

In arriving at this conclusion, we are gratified in finding that it is fully indorsed by the recommendation of the two last Executives of the State in their annual communications to the Legislature.

Governor Coburn, in his message to the Legislature in 1863, treating of the subject under consideration, says:

"There can be no doubt, I think, that vast benefits will flow from this act (act of Congress), and I have no hesitation in urging upon you the prompt acceptance of its terms and conditions. As none of the proceeds arising from a sale of lands can be devoted to the erection of buildings, it may be *expedient*, and, indeed, *absolutely necessary*, to allow some of our *existing institutions* to avail themselves of the benefit of the grant, provided satisfactory guaranties can be given that its design will be faithfully carried out."

Governor Cony, in his address to the last Legislature, says:

"While among the sciences to be taught, it is declared that the leading object is to teach those relating to agriculture and the mechanic arts, the language of the act making the grant declaring specifically that it is not its purpose to exclude other sciences, is pregnant with the conclusion that the *design was to establish institutions of learning of the highest order*, for its scope is as comprehensive as its whole spirit is liberal."

"If Maine is to have the institution which this grant designs, the Legislature will find it necessary either to endow a *new one, with a very liberal amount* of funds to *start it*, to be *followed by annual appropriations to the end of time, or avail itself of some one of those already existing*, which has heretofore been the recipient of the bounty of the State, *securing thereby edifices, library and laboratory*—the gathered results of large expenditure and patient effort, *indispensable to the proposed institution, demanded by the purposes of the grant*, and the *first* and *most expensive* to be provided by the *State*. Without the slightest preference as to what institution shall be selected with which to connect the Agricultural College, my convictions are very decided that it is expedient to adopt some one of them."

We abstain from presenting in detail our views of the way and manner in which the affairs of the proposed Institution should be conducted, of the branches to be taught, and the methods of instruction, because the consideration of that subject is not committed to us; but we would respectfully commend to the careful consideration of the Committee, to whom that duty may be intrusted, the report of the Committee on Agricultural Schools to the Legislature of Massachusetts, made at its January Session, 1851, House Doc. No. 13, and especially to the communication of Professor Hitchcock, which makes part of that report.

We cannot refrain, however, from expressing the opinion that among the branches most important to be taught are practical agriculture and horticulture, chemistry elementary and applied, natural history, especially zoology and botany, elementary and applied mineralogy and geology, anatomy and physiology, human and comparative, veterinary medicine and surgery, mathematics as applied to civil engineering, surveying, irrigation, draining, construction of roads and bridges, &c., &c., book-keeping and military tactics.

Agricultural law, or rural legislation, comprising the rights and duties of owners and occupiers of lands as to fences, ways, water-courses, upon streams, rivers, ponds and tide-waters; titles to real estate under deeds, leases, grants, &c., and the duties of persons acting in a representative capacity would also be a very desirable and useful branch of instruction, not comprehended in the course of instruction in any literary institution now existing in the country. Instruction in this department might be given by a lecturer, or by the Professor in some other department.

We are also of opinion that a farm and workshop, collections of dried seeds and grasses, of minerals, rocks, soils, marls, clays, &c; of insects injurious to vegetation, a chemical and philosophical apparatus, and a scientific and agricultural library are equally desirable, and, indeed, necessary appendages to such an institution.

To carry out this idea thoroughly, and make the institution as efficient as we all desire it should be, the following Board of Instruction would be required:

1. A Professor of Mathematics.
2. A Professor of Elementary and Agricultural Chemistry.
3. A Professor of Agriculture, theoretical and practical.
4. A Professor of Natural History and Geology.
5. A Professor of Anatomy, Physiology, and Veterinary Medicine and Surgery.
6. A Professor of Civil and Rural Engineering.
7. An Instructor in Military Tactics.
8. A Superintendent of the farm and gardens.
9. A Superintendent of the work-shop.

To this list may be added a Professor of Horticulture and Agricultural law. It is not improbable that the duties of two or more of the Professorships above enumerated may be discharged by one and the same person possessing the requisite qualifications.

HISTORY, &C., OF SIMILAR INSTITUTIONS. The Resolve under which we act makes it the duty of the Commissioners "to learn what they can of the history, present working and prospect of usefulness of similar institutions."

Institutions for instruction in agriculture and the mechanic arts are of so recent origin in this country that they can hardly be said to have a history. Not so on the other side of the Atlantic. Mr. Colman, in his able Report on European Agriculture, completed in 1844, describes nine agricultural schools only, although others then existed, probably, but of too insignificant character to attract his notice. Professor Hitchcock, in his Report made in January, 1851, enumerates three hundred and fifty-two. This rapid increase in number is an argument in favor of the recognized beneficial influence of such institutions. The mode of operation of those schools, the branches of instruction, the objects sought, and the best method of attaining those objects, are fully set forth in that Report; we would gladly embody it in this, were it not too voluminous, and were it not within your reach. We refer to it for all the information of value we are able to communicate in relation to the practical working of institutions of this character.

Argument is not required to prove, what with us has become a truism, that the diffusion of education among the people is productive of incalculable benefit; but education implies something more than instruction in reading, writing and arithmetic, the Latin, Greek and French languages; it embraces every acquirement necessary to enable a man to discharge every duty devolving on him as a member of the great human family, every duty incident to his profession or calling in life.

We cannot all be members of the *learned* professions, as they are styled, or merchants, farmers or mechanics; but we all have a common interest that each and every one should be thoroughly educated in his calling, be it what it may; for the extent of his education in such calling is, in a great degree, the measure of his usefulness in society.

The best interests of the community require that the lawyer should be something more than a pettifogger, the physician than a quack, the merchant than a huckster, the farmer than a mere clodhopper, the mechanic than a botcher. The means and appliances for the education of the lawyer, the physician, the merchant, have already been brought to bear on their several departments in business life; not so with the farmer and the mechanic. An opportunity is now presented of supplying that well recognized deficiency; the opportunity should not be neglected.

We should not dispose of this topic with these brief remarks, had it not been most thoroughly discussed by the very able Secretary of the Board of Agriculture, in his Report for 1862, pp. 146–153, to which we beg leave to call your attention; as, also, to his Report for 1863, pp. 268–271, under the title, "Proposed Agricultural College," and his Report for 1859, pp. 249–264.

W. G. CROSBY,
JOS. EATON,
SAM'L F. PERLEY, } *Commissioners.*

December 19, 1864.

APPENDIX TO FOREGOING REPORT.

An act donating lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there be granted to the several States, for the purposes hereinafter mentioned, an amount of public land, to be apportioned to each State a quantity equal to thirty thousand acres for each senator and representative in Congress to which the States are respectively entitled by the apportionment under the census of eighteen hundred and sixty. *Provided,* That no mineral lands shall be selected or purchased under the provisions of this act.

SECT. 2. *And be it further enacted,* That the land aforesaid, after being surveyed, shall be apportioned to the several states in sections or sub-divisions of sections, not less than one quarter of a section; and whenever there are public lands in a state subject to sale at private entry at one dollar and twenty-five cents per acre, the quantity to which said state shall be entitled shall be selected from such lands within the limits of such state, and the Secretary of the Interior is hereby directed to issue to each of the states in which there is not the quantity of public lands subject to sale at private entry at one dollar and twenty-five cents per acre, to which said state may be entitled under the provisions of this act, land scrip to the amount in acres for the deficiency of its distributive share; said scrip to be sold by said states and the proceeds thereof applied to the uses and purposes prescribed in this act, and for no other use or purpose whatever: *Provided,* That in no case shall any state to which land scrip may thus be issued be allowed to locate the same within the limits of any other state, or of any territory in the United States, but their assignees may thus locate said land scrip upon any of the unappropriated lands of the United States subject to sale at private entry at one dollar and twenty-five cents per acre: *And provided further,* That not more than one million acres shall be located by such assignees in any one of the states: *And provided further,* That no such location shall be made before one year from the passage of this act.

SECT. 3. *And be it further enacted,* That all the expenses of management, superintendence, and taxes from date of selection of said lands, previous to their sales, and all expenses incurred in the management and disbursement of the moneys which may be received therefrom, shall be paid by the states to which they may belong out of the treasury of said states, so that the entire proceeds of the sale of said lands shall be applied without any diminution whatever to the purposes hereinafter mentioned.

SECT. 4. *And be it further enacted,* That all moneys derived from the sale of the lands aforesaid by the state to which the lands are apportioned, and from the sales of land scrip hereinbefore provided for, shall be invested in stocks of the United States, or of the states, or some other safe stocks, yielding not less than five per centum upon the par value of said stocks; and that the moneys so invested shall constitute a perpetual fund, the capital of which shall remain forever undiminished, (except so far as may be provided in section fifth of this act,) and the interest of which shall be inviolably appropriated, by each state which may claim the benefit of this act, to the endowment, support, and maintenance of at least one college, where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.

SECT. 5. *And be it further enacted,* That the grant of land and land scrip hereby authorized shall be made on the following conditions, to which, as well as to the provisions hereinbefore contained, the previous assent of the several states shall be signified by Legislative acts:

First. If any portion of the fund invested, as provided by the foregoing section, or any portion of the interest thereon, shall, by any action or contingency, be diminished or lost, it shall be replaced by the state to which it belongs, so that the capital of the fund shall remain forever undiminished; and the annual interest shall be regularly applied without diminution to the purposes mentioned in the fourth section of this act, except that a sum not exceeding ten per centum upon the amount received by any state under the provisions of this act, may be expended for the purchase of lands for sites or experimental farms, whenever authorized by the respective legislatures of said states.

Second. No portion of said fund, nor the interest thereon, shall be applied, directly or indirectly, under any pretence whatever, to the purchase, erection, preservation, or repair of any building or buildings.

Third. Any state which may take and claim the benefit of the provisions of this act shall provide, within five years, at least not less than one college, as described in the fourth section of this act, or the grant to such state shall cease; and said state shall be bound to pay the United States the amount received of any lands previously sold, and that the title to purchasers under the state shall be valid.

Fourth. An annual report shall be made regarding the progress of each college, recording any improvements and experiments made, with their cost and results, and such other matters, including state industrial and economical statistics, as may be supposed useful; one copy of which shall be transmitted by mail, free, by each, to all the other colleges which may be endowed under the provisions of this act, and also one copy to the Secretary of the Interior.

Fifth. When lands shall be selected from those which have been raised to double the minimum price, in consequence of railroad grants, they shall be computed to the states at the maximum price, and the number of acres proportionally diminished.

Sixth. No state, while in a condition of rebellion or insurrection against the government of the United States, shall be entitled to the benefit of this act.

Seventh. No state shall be entitled to the benefits of this act, unless it shall express its acceptance thereof by its legislature within two years from the date of its approval by the President.

Sect. 6. *And be it further enacted,* That land scrip issued under the provisions of this act shall not be subject to location until after the first day of January, one thousand eight hundred and sixty-three.

Sect. 7. *And be it further enacted,* That the land officers shall receive the same fees for locating land scrip issued under the provisions of this act, as are now allowed for the location of military bounty land warrants under existing laws: *Provided,* Their maximum compensation shall not be thereby increased.

Sect. 8. *And be it further enacted,* That the governors of the several states to which scrip shall be issued under this act, shall be required to report annually to congress all sales made of such scrip, until the whole shall be disposed of, the amount received for the same, and what appropriation has been made of the proceeds.

Approved July 2, 1862.

I am deeply gratified in being able, through the courtesy of the Commissioners, to present to the farmers and mechanics of the State, as well as to the Legislature, their very able report, in the foregoing pages.

My own views have been so often and so fully expressed in previous reports, that it seems needless to do more at the present time than to submit a few brief remarks and suggestions.

1st. Although the public burdens are very heavy and are likely to continue so, the State is not yet reduced to pauperism, nor are its inhabitants unable or unwilling to support and maintain such institutions as are needful to secure a fitting and useful education to their children.

2d. By the Constitution it is made the duty of the Legislature, (this body has several powers conferred upon it, but almost the only *duty* distinctly defined by the Constitution is,) "to encourage and suitably endow, from time to time, as the circumstances of the people may authorize, all academies, colleges and seminaries of learning within the State."

3d. Few towns would hesitate to accept a very liberal grant offered to them for the support and maintenance of a useful and necessary school, conditioned upon their raising a smaller sum in aid of the same.

4th. The classes for whose benefit the proposed college is especially designed are very numerous; they bear a very large proportion of the public burdens. Equally with the so called learned professions they have ever valued and cherished institutions of learning, and have cheerfully contributed of their substance for their support.

5th. So far as I am acquainted with the views of the industrial classes in Maine, their preference is strongly in favor of a separate and independent institution. They have, as yet, expressed no unwillingness to aid, if necessary, in establishing the proposed college upon an independent basis.

6th. The literary colleges have received bounty from the State with a liberal hand. What valid reason exists why this alone should receive no aid whatever from the same source?

7th. The proposition of Bowdoin College, although doubtless submitted with a willingness to admit of some modifications, indicates an appreciation of the importance of practical instruction considerably at variance with that held by many who are deeply interested in the successful working of the Industrial College. It proposes no workshop, and that labor on the farm be optional with the student. Another view is, that the workshop with its fixtures and tools, and the farm with its stock, its implements and its crops, are necessary and indispensable portions of its apparatus for instruction, *and should be in daily use as such*; that a student in chemistry might as well confine himself to the reading of text books, listening to lectures and attending to recitations, without practice in the laboratory, as a student in agriculture might, at his option, keep aloof from the farm.

8th. Then, too, with regard to the proposed course of study; it is certainly a very comprehensive one to be mastered in the term mentioned—one year—a length of time insufficient, in the opinion of some, to enable any ordinary student to acquire even a meagre and rudimentary acquaintance with the branches of study which are named, and in which courses of instruction "shall be completed within one year."

9th. It seems very desirable, at least, that, together with a diffusion of knowledge in connexion with the training of youth, the proposed institution might contribute somewhat towards an actual increase of knowledge. This can only be done by laborious investigations, conducted by such persons as have attained what is known in their several specialties, and are possessed of skill, ability, means, patience and an earnest desire to push forward for more. Agriculture, *as an art*, has been pursued for six thousand years or more. Diverse opinions have been held on many points of practical importance. Experiments without number have been tried by thousands in all ages to ascertain the truth concerning these same points, and the diversity of opinion is scarcely less to-day than it was in the times of Cato, Virgil or Columella. Why is this? Just because the problems involve so many intricacies and complications, always with subtle forces and laws of matter, not fully understood, and very often with the laws of organic life and being, of which still less is known, that a successful solution would require a degree of knowledge and skill and care and precision in the operator to conduct the needful experiments in the best manner and with all the appliances of science to enable him to eliminate errors, and having done this, to repeat the experiments again and again under all the varying conditions of soils, seasons, &c., &c., &c., that not one person in a thousand, and probably not one in a million, possesses the skill, the means and the patience to conduct them to a demonstration. Something is now being done abroad to good purpose. Probably more has been accomplished towards solving the problems of European agriculture within the past twenty years, than in the twenty centuries previously. Something ought to be done here; and where and how can it be better done than by the corps of such an institution?

10th. While the training, development and instruction of the youth who attend the college course must necessarily occupy to a large degree the efforts of professors and teachers, it seems highly desirable, if practicable, that their direct influence and teachings might reach larger numbers than can possibly be gathered within the college walls. Might not this be effected by having a considerable interval between the regular terms of study, and a part of this interval devoted to the delivery of courses of public lectures, say during the winter months, at various central points in the State at a distance from the college proper; which courses of lectures should be free to all, or with a fee barely sufficient to defray incidental expenses? Several advantages might be expected to accrue from the adoption of such a plan. It would serve to bring the institution to the knowledge of, and into intimate relations with great numbers of the industrial classes who would otherwise remain in ignorance of, or comparatively uninterested in its existence or operations. The people would sooner feel that this was their own institution; they would feel a deeper interest in it, a sense of property in it, would more freely extend to it their sympathy, coöperation and support. The number of regular students would more rapidly increase, and the reflex influence of such a direct mingling with sturdy practical farmers and mechanics would be highly beneficial upon the corps of teachers, and enable them to do more effective service.

I crave your indulgence for the crudeness of these remarks and suggestions, which are necessarily penned in haste and with little time for elaboration or revision. They are offered with extreme diffidence and only because of an earnest desire to assist, in however feeble a measure, towards the adoption of a wise plan in a matter of vast prospective importance.

S. L. GOODALE,
Secretary of the Board of Agriculture.

JANUARY, 1865.

INDEX.

PAGE.
Apple Orchards, Profit of 41
Apples, discussion of 39
Agricultural College, Report of Committee, 74
    Report of State Commissioners, 177
    Suggestions relative to, 205
Aquæculture, 98
Beet Sugar, 168
Bone Manure, 88
Blackberry, culture of 167
Chicory as a Substitute for Coffee, 172
Cherry, culture of 138
Currant, culture of 161
Farm Stock, 25
Fish Offal as Food for Sheep, 42
Gooseberry, culture of 166
Grape, culture of 140
    Hartford Prolific, 154
    Delaware, 154
    Northern Muscadine, 155
    Concord, 156
    Adirondac, 159
    Iona, 169
    Israella, 160
    other varieties, 156, 161
Geological Survey, Shall it be resumed? 81
Improved Agriculture, Essay on 11
Injury to Sheep from Dogs, 6
Influence of Manufactures on Agriculture, 50
Immigration, resolves and discussion on 83
Marine Manures, 44
Muscle-bed as a Fertilizer, 46
Methods of increasing the usefulness of Agricultural Societies, 76
Plum, culture of 136
Propagation of Fish, Artificial 118
Profitable Branches of Husbandry, 78
Sex of Offspring, on regulating 175
Small Fruits, Essay on culture of 29
Salt, Essay on, as a Fertilizer, 22
Sheep Husbandry, 8
Superphosphate of Lime, 88
Wheat Culture, 18
Willow, Osier, 64

ERRATA. Page 3, stating expiration of term of members, for 1867 read 1865, for 1865 read 1867.

ABSTRACT OF RETURNS

FROM THE

AGRICULTURAL SOCIETIES

OF

MAINE.

1864.

EDITED BY
STEPHEN L. GOODALE,
SECRETARY OF BOARD OF AGRICULTURE.

AUGUSTA:
STEVENS & SAYWARD, PRINTERS TO THE STATE.
1865.

PREFACE.

An abstract of the returns from the Agricultural Societies of Maine for 1864, with the accompanying papers, is presented to the farmers of the State, with the hope that it will contribute, in some degree, to the advancement of the knowledge and practice of agriculture among us.

In the doings of the County Societies is to be found much that will be of more than local interest; while the valuable and practical papers composing the remainder of the volume, selected from sources not generally accessible to the farmers of the State, are commended to their special attention as containing the best thoughts of some of the ablest agricultural writers of the day.

TABLE OF CONTENTS.

TRANSACTIONS OF COUNTY SOCIETIES:

	PAGE.
Androscoggin County,	3
Cumberland County, and Portland Horticultural,	5
Hancock County,	6
North Kennebec Society,	7
Kennebec Union Society,	10
Lincoln County,	13
Oxford County,	16
North Penobscot Society;	17
West Penobscot Society,	20
Piscataquis County,	22
Sagadahoc County,	25
East Somerset Society,	27
Waldo County,	28
North Waldo Society,	29
Washington County,	30
West Washington Society,	36
York County,	37
Address of E. R. French,	39
" of Dr. Ezekiel Holmes,	111

SELECTED PAPERS:

Chemistry of Practical Farming,	54
Principles of Breeding Farm Stock,	96
Breeding of Hunters and Roadsters,	123
Nature and Composition of Food,	149
Breeding and Management of Pigs,	187

TRANSACTIONS

OF

AGRICULTURAL SOCIETIES OF MAINE.

1864.

COMPILED FROM RETURNS OF AGRICULTURAL SOCIETIES FOR THE YEAR ENDING DECEMBER, 1864.

Societies.	Amount received from the State.	Amount raised by the Society.	Amount of Premiums offered.	Amount of Premiums awarded.	Offered for Live Stock.	Awarded for Live Stock.	Offered for Grain and Root Crops.	Award'd for Grain and Root Crops.	Awarded for all other objects.
Androscoggin, . .	297 26	994 14	490 00	480 00	272 00	205 50	89 00	32 25	45 50
Aroostook, (North) .	99 23	309 68	221 18	132 55	110 65	80 25	48 99	7 87	44 43
Franklin, ...	108 21	300 00	319 20	176 05	206 50	121 50	20 40	2 70	74 95
Franklin, (North) .	95 82	152 00	182 77	123 55	93 35	71 95	–	9 75	37 60
Hancock, ...	376 00	711 00	660 50	–	330 50	221 50	80 00	25 25	267 75
Kennebec, ...	136 14	366 73	417 19	271 62	275 75	203 75	49 00	23 00	60 00
Kennebec, (North) .	115 35	535 95	446 75	189 11	222 00	122 00	33 00	–	76 71
Lincoln, ...	278 60	447 29	425 00	311 00	212 00	110 00	51 75	35 25	165 75
Oxford, ...	157 13	609 07	274 00	234 98	173 00	137 00	42 00	10 00	74 88
Oxford, (West) . .	148 00	393 00	330 50	189 75	170 75	69 75	41 00	15 75	22 50
Piscataquis, . . .	123 38	112 25	192 59	162 62	94 50	76 00	27 00	16 00	50 75
Penobscot, (North) .	85 95	94 57	379 25	171 54	154 75	78 00	113 50	21 00	29 12
Penobscot, (West) .	186 52	201 25	644 90	210 40	419 50	96 50	112 50	33 75	80 15
Sagadahoc, . . .	281 16	920 05	566 75	468 39	279 50	229 50	91 75	46 50	172 39
Somerset, (West) .	118 01	414 90	220 50	193 82	175 00	169 22	–	–	28 90
Somerset, (East) . .	65 66	276 85	192 00	133 74	113 00	87 00	28 75	15 00	27 00
Waldo, ...	252 41	717 85	572 50	462 00	186 00	374 00	53 00	30 50	57 50
Waldo, (North) . .	90 75	167 75	190 50	152 00	149 50	110 50	–	22 00	19 50
Washington, . . .	–	405 75	370 00	242 15	240 00	199 75	64 50	7 75	39 40
Washington, (West)	–	302 73	379 45	354 55	171 00	170 00	24 25	14 75	192 90
York, ...	400 00	779 16	800 00	519 35	445 50	349 00	117 00	33 00	124 35

ANDROSCOGGIN COUNTY AGRICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

The Annual Show and Fair of this Society was held at Lewiston, October 6th, 7th and 8th. The weather was very favorable, and we had one of the largest exhibitions of animals and agricultural products that we have had since the organization of the Society.

The attendance was very large, consequently our receipts were increased from last year very much, making our financial condition look more favorable.

The leading crops in the county are hay and potatoes. The quantity of hay was fully an average, and the quality never was better. During the usual season of the growth of the potato it was extremely dry, and it did appear that the crop would be a failure. But the rains came at last, the tops revived, and we have secured one of the best crops ever grown, as regards both quantity and quality. The corn crop has been an average one, and of excellent quality. Wheat nearly a failure, though but little sown. Barley was sown quite extensively, but owing to the drouth was very light, not more than half the usual crop. The same may be said of oats. The crop of fruit is below the average. The prices of all products of the farm have greatly increased, and I think the farmers' prospects are encouraging.

There were on exhibition seventy pairs of oxen and steers, most of them well matched in shape and color, and well disciplined. More good milch cows were present than usual, and it is evident more attention is being paid to the rearing and selection of good cows than formerly. Thorough-bred Durhams, Jerseys and Ayrshires were shown.

Eighty-five horses and colts were on the grounds. Many very fine and some very superior animals were shown, giving evidence that this branch of industry is not neglected. The number of sheep was much larger than at former shows.

The exhibition of dairy products was very creditable, there being twenty-one samples of very nice butter and twelve of cheese. The display of manufactured cotton and woolen goods from the different mills in this place contributed very much to the attraction of the Fair, and the agents are entitled to the thanks of the Society for the interest they manifest in our annual festival.

Fruit was shown in abundance, and the Committee remark that: "All the contributors to the show of fruit are deserving of praise for the pains taken to produce the best varieties, and to grow perfect specimens of these kinds. They must feel amply rewarded for their efforts in the enjoyment which the use of such fine fruit secures. The Committee may be permitted to say that they do not deem it desirable to cultivate a large variety of apples, but rather a few of the best kinds, so as to secure a succession of well-ripened fruit from early fall to late spring. If any choice variety has no name, let it receive one, that it may be known as well as the Baldwin and Greening, then they can have a reputation, and their marketable value will be increased. It is with feelings akin to pride that we speak of the sweet 'Gloria Mundi,' the 'Garden Apple' and the 'Briggs Auburn' as natives of this county. He who wishes for the best fall apples will do well to cultivate these fine varieties, since the fruit is not only excellent, but large and fair, and the trees good bearers. The apple crop is one of our best and most valuable ones, and may be made highly promotive of health, economy and enjoyment.

The cultivation of pears has been too much neglected in our county, owing, perhaps, to the long time a standard tree is in coming into bearing, and their supposed lack of hardiness. But the dwarf pear tree comes early into bearing, and is quite hardy when *not* set in a warm, sheltered situation, and is a good bearer when properly taken care of. These may be used while the standard tree is coming into bearing."

In domestic manufactures, drawings and paintings, shell work, and in fancy articles generally, the ladies did their full share.

NELSON HAM, *Secretary.*

CUMBERLAND COUNTY, AND PORTLAND HORTICULTURAL SOCIETIES.

Mr. S. B. Beckett, the Secretary of these two Societies, writes me that for various reasons which, according to the Executive Committee, were deemed sufficient, the Cumberland County Society held no exhibition during the year 1864. Consequently the By-Laws of the Society were so changed, that hereafter all officers hold over until new ones are elected.

Of the operations of the Portland Horticultural Society, he says:

"The Society embraces one hundred and twenty members.

We have had three exhibitions during the year, viz.:

May 4th. Of greenhouse plants and flowers.

June 30th. Of strawberries.

Oct. 5th. Of vegetables, fruits, plants and flowers.

The result of the Society's operations and endeavors has been,

1. A large increase in the cultivation of pears, apples, plums and grapes, and the introduction to the section of its influence of many and choice varieties of these fruits.
2. Great improvement in the laying out and ornamenting of gardens and grounds.
3. Greater skill and success in the cultivation of garden vegetables generally.

All these results are patent to the most casual observer."

HANCOCK AGRICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

The Show and Fair of our Society this year was, everything considered, the best ever held by the Society. The stock was less in numbers, but of a decidedly improved character. Our farmers are learning that *breed* has a money value. Another encouraging feature was, that many of our substantial farmers, who have heretofore stood aloof, have become interested and active members. The show of field crops, on account of the dry season, was not up to the average. The exhibition of fruit was better than ever before. Each year in its turn is adding increased evidence of the influence of the Society upon our farmers, even upon those who are not members. Our finances are *now* in a healthy condition. We are fast getting out of debt.

S. WASSON, *Secretary.*

NORTH KENNEBEC AGRICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

In the first year of the war the managers of our Society were almost persuaded to suspend operations, supposing that the attention of the people would be monopolized by weightier matters. The debt of the Society was then more than a thousand dollars; and it was feared that if we attempted to go forward we should fail and bring a still heavier burden upon our shoulders. After careful deliberation it was finally determined to proceed as usual, as though we had no war on our hands, and the results of each year have justified the wisdom of the conclusion. True, the receipts have not been large in any year, but by prudent management we have nearly extinguished our debt; and, still better, we find a growing interest in agriculture and the prosperity of our Society.

Our Show and Fair was held a week earlier than usual this year that it might not interfere with the exhibition of the Waterville Horse Association, and we were favored with good weather on both days. The Show was very successful—the exhibition at both grounds and hall surpassing that of any previous year during the war, while the number of members were largely increased and the receipts very satisfactory.

The exhibition of stock, as a whole, was never surpassed at our grounds, whether we consider the number or the excellence of the animals, and this was pre-eminently true of three classes—horses, oxen and sheep.

The introduction of first class stock horses into this State—a noble enterprise, mainly the work of T. S. Lang, Esq.,—begins to bear golden fruit, and the farmers of Maine are already gathering a rich harvest. "Knox colts" are at a premium since the "General's" victory at Springfield gave him a national reputation, and it is not uncommon to hear of their being sold for one thousand dollars each at the age of two years. We are aware that a portion of this increase of price is due to the inflation of the currency, but not the larger part; and if the enterprise is prospered it will soon materially swell the valuation of the State. A large number of fine Knox colts were on the ground, distancing all competitors and taking all the prizes.

What Mr. Lang is doing for the horses of Maine he is also aiming to do for the neat cattle, as is evidenced by the introduction of choice thorough-breds at great expense. Though he entered nothing for premium, this gentleman was present with thirty-two head of cattle, including six thorough-bred Short Horn cows, and five superior grade cows, with several full blood yearlings and calves; a Dutch bull and heifer, the first of the kind brought into this section; several pairs of very large and handsome oxen, and one fine Durham bull under three years old, which girted seven feet and four inches, and weighed 1,820 pounds.

But others have preceded Mr. Lang in this department, as the long line of noble oxen present abundantly proved; and among the self-sacrificing pioneers in the good work, we may mention Col. R. H. Green, of Winslow, who has always been an active member of our Society.

Hon. Warren Percival, of Vassalboro', another worthy laborer in the same field, but whose attention has been more particularly directed to the improvement of dairy stock, was also present with two choice bulls. They were not entered for premium.

There is good dairy stock in this section, both native and foreign, but very little of it is ever brought to our annual exhibitions—the owners not deeming the small premiums offered a fair return for the trouble of complying with the rules of the Society.

No less than thirty lots of sheep, including several fine flocks, were present at our Exhibition. The large number of valuable bucks on exhibition showed that some folks know "how to do it," and their introduction into this section promises well for the future. A very valuable one, raised by Cushing, of Vermont, and lately purchased by Joshua Nye, Esq., took the first premium.

A very pleasing feature of the Show, and one deserving a prominence not often accorded to it on these occasions, was the exhibition of trained steers by boys. Surely, while growing fine oxen at a large outlay of labor and expense, it is equally important that we make some attempts to improve their drivers, and thus ensure the proper care and discipline of the animals it has cost so much to raise, with the highest possible development of their capacities. The performance of Master Rice, who has made his appearance here at several successive Shows, was very creditable to him and the animals under his charge. His quiet and gentle manner, and his intelligent treatment of his young team, was in marked contrast to the old system—which is *no* system—a cruel use of the goad, with a free accompaniment of oaths and yells. Many old teamsters, who pride themselves upon their performances at prize haulings, might have learned a valuable lesson.

The Fair at the hall opened on Tuesday evening with a Farmers' Levee—a novel feature, but one which we hope to see perpetuated, with additions and improvements. A yearly gathering of this sort, where old and young may freely mingle, with a little good music, and a lively interchange of kindly greetings and pleasant social chat—an occasion to be looked forward to with delightful anticipation and that would live in pleasant remembrance—would do much to enhance the importance of our annual festival, and foster an interest in our own as well as other societies.

An increased interest was manifested in all departments.

The show of fruit was very large and handsome; indeed, we think it has never been excelled with us. Among those who were present with choice and rare varieties of apples were Dr. G. T. Waters, who has done wonders with a few old worn-out trees in a small village garden, and H. P. Carr, Esq., of China, who has stocked a large orchard with the choicest fruit at great expense of time, labor and money. The other prominent contributors were J. M. Pressey, Moses E. Penney, Charles Drummond, Alden Bassett and Obed Emery, with apples; I. S. Clifford, with pears, and J. Goodwin, with beautiful specimens of grapes, of which he is a very successful cultivator. Much as has been done for orcharding in Maine, the increased supply of fruit has not kept pace with the demand, and no branch of farming pays better if rightly managed.

There was a tempting display of dairy products, showing that there are good cows in the country though they are not driven to the cattle show, and a larger number than usual of articles from the households of the members—specimens of the handiwork of their wives and daughters—furnished gratifying evidence that a new interest has been awakened in this long-neglected department.

DANIEL R. WING, *Secretary.*

KENNEBEC UNION AGRICULTURAL AND HORTICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

Our Show was holden at Gardiner on the 5th and 6th of October, and in many particulars exceeded the most sanguine expectations of its officers. The weather was fine, but the dull day preceding probably had the effect to keep at home a few exhibitors who would have been present under other circumstances.

The neat stock present, with exception of bulls, showed an advance in the right direction from former years, especially in the number, symmetry, discipline and power of working oxen and steers. Though most of the animals were grades, it must be admitted that the hap-hazard crossing of Natives, Durhams, Devons, Jerseys and Ayrshires has produced some excellent specimens of stock. The best specimens of these grades, (not a few,)—oxen, steers, cows and heifers—in size, symmetry of form and apparent adaptedness to the purposes for which they were reared could hardly be excelled by blood stock of any of the imported races or breeds.

Of horses, there was no lack. The greatest improvement was witnessed in the number and character of the breeding mares and their progeny. If this feature is equally apparent in other sections, it affords pretty certain evidence that the vacuum created by the large draft of horses for army purposes will soon be filled, and by a better class of animals than has heretofore been raised.

The sheep department was better filled than last year, most of them being grades. The high price of wool has considerably increased the flocks in the vicinity; but farmers here are not generally pursuing sheep breeding with that system which prevails in other States and other portions of this State.

The display of fruit, vegetables and seeds was a success. The whole amount of money offered by the Trustees on the numerous classes under these heads might have been awarded by the Committee to deserving competitors in prizes on pears, plums and grapes, leaving the king of fruits, apples, with the garden vegetables and seeds, of which the collections were considerable in numbers and superior in quality, without any such commendation of their merits. Besides the increasing numbers of choice new varieties of fruit, and improved quality of old ones, at our exhibition, we have other unmistakable proof of advancement in this direction. The more general planting of young trees, and the better care of them, is observable in every direction. Those unsightly moss-grown orchards, with broken limbs and stunted and gnarled fruit, are less frequently to be seen, though some of these eye-sores still remain.

The ladies were in advance of the sterner sex (especially of that portion of them termed mechanics) in their contributions to the Exhibition. The butter and cheese, flowers and plants, household manufactures, embroidery and other substantial and ornamental proofs of their industry and skill was highly creditable to them, and encouraging to the officers and friends of the Society; especially so when we take into the account the large draft upon their time which the liberal responses they have made to repeated calls of the Christian and Sanitary Commissions within the past year must have occasioned.

In my remarks, in a former report, upon some of the hindrances to the success and usefulness of agricultural associations, and to the advancement of the cause of agriculture in the State, I alluded to societies being left to struggle on as best they can, without the countenance and support of men of means and influence who are engaged in other occupations, and of men who are living on the income of resources accumulated in the pursuit of other occupations.

As my remarks seem to have met approval, I venture to add some further thoughts on this and other subjects. Though there are many honorable exceptions, it is too generally true that men of the highest standing and largest means withhold the aid which it would seem self interest alone would prompt them to bestow; and I believe this will be found more generally true in this State than any other in New England. If it is said that such men wait to receive an invitation, the answer is at hand. They have had repeated invitations from every quarter. If they are of the opinion agricultural societies and the cause of agriculture generally will succeed without their aid, in this they are right. Success is their "inevitable destiny." Success in every other department of productive labor, and every avocation of life is dependant on success in this—more dependant than on any other—not intending to deny a mutual dependence to as great an extent as any claim. After making all this admission, it may truthfully and consistently be stated that the want of their entire aid is severely felt all over the State. We cannot, in any view of the subject, suppose men so blind to the law of mutual dependence as to think they have no interest in the success of productive labor except in their own particular calling, and that under their immediate direction. The charitable view I am disposed to take is, that the apparent apathy of professionals and others alluded to arises more from a want of a due consideration of the responsibility resting on them in this matter, than from any unwillingness to meet the necessary draft on their time or their purses. If this be so, how shall we enlist them in the cause?

The interest of our exhibitions is often seriously marred by a want of understanding, on the part of officials as well as competitors, of the duties required of them, causing hurry and confusion. It is a fact that many competitors present themselves and their articles at the exhibition without ever having seen or heard that they have anything to do but to take their money and go home when *they* get ready. Judges often have not seen any of the regulations adopted by the Society, or the laws enacted by the State, and perhaps, for the first time, learn that they have been appointed when called to act. A more thorough preliminary arrangement may, in a measure, remedy this difficulty. Let the Secretary, or some other officer whose duty it shall be, procure printed slips, specifying minutely the duty of every competitor, to pass into his hands at the time of making his entries, and also slips for the judges, stating definitely the duties expected of them. These to be in addition to the usual circulars and posters, they being often too comprehensive for examination, further than to find the amount of premium offered on the particular article presented, and oftener never having been seen at all. * * * * * * *

NATHAN FOSTER, *Secretary.*

LINCOLN COUNTY AGRICULTURAL AND HORTICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

To Hon. S. L. Goodale, Secretary of the Board of Agriculture:

DEAR SIR:—Herewith I forward you a condensed statement of the doings of the Lincoln County Agricultural and Horticultural Society, which held its Annual Show and Fair at Waldoboro', Oct. 12th, 13th and 14th, 1864.

First permit me to say a word in commendation of your admirable report which comes to us yearly freighted with a fund of useful information, gleaned from sources not accessible to a large majority of our people. We trust that this source of agricultural knowledge may not be denied us in years to come, let whatever may betide our local societies.

Our Fair the present year was a decided success in the amount and quality of articles exhibited; and financially, very satisfactory, considering the fact that a drenching rain the second and third days precluded the possibility of any exhibition of ploughing, drawing and training, or trotting, as was contemplated. In the horse department, many medium and a few very superior animals were exhibited.

James Ulmer, of Rockland, was awarded the Society's first premium for the best entire horse—breed known in this vicinity as "Carroll." This animal was well made up and of fine carriage, but was noted more for those qualities which make a good farm horse rather than those indicating speed.

Some twenty specimens of colts, from one to three years old, were exhibited. These colts in a forcible manner verify a remark made by the Secretary of a neighboring society, viz.: "That the colts were better than their dams." This shows improvement in the right direction, which, if judiciously followed, will, at no distant day, place Lincoln county in a position for producing good horses second to none in our State.

John Butler, of Union, gives us the only reliable statement received in regard to the value and expense of rearing. He entered for premium a colt four years old, June 1, 1864. Pedigree, French and Morgan. Expense of rearing the first year, $25; second, $35; third, $50; fourth, $65; total expense, $175; present value, $400.

In neat stock our show was an improvement on former years, particularly in well matched oxen and steers. A few good specimens of cows and heifers were exhibited, but nothing worthy of note was elicited from their owners.

Sheep husbandry continues largely on the increase in this county. Our farmers, like our merchants, have a keen eye to the profits accruing from any undertaking, and actual experiment has demonstrated that the net profits received from a herd of sheep when properly husbanded is in excess of that derived from any other department of stock raising. For this locality, grade Cotswolds and a cross between the Spanish Merino and our common Natives are preferred, they being hardier and better calculated to procure their living on the not over fertile hill-sides of this sea-coast region, than the Leicester or Southdown.

Miles T. Benner, of Whitefield, received the first premium on grade Cotswold Buck. Weight, 200 pounds. Said to shear from twelve to fifteen pounds of wool annually. Charles A. Fogler, of Waldoboro', was awarded the first premium on best flock of sheep—breed, Natives. Average yield of wool per head, three pounds and three quarters.

The specimens of butter and cheese were somewhat limited, but of excellent quality.

Our exhibition of field crops was small, with the single exception of corn. The present season, notwithstanding the severe drouth, seems to have been peculiarly adapted to the growth and maturing of this crop. Some forty samples were exhibited, any one of which was fully equal to those receiving the first premium in years past.

The exhibition of root crops and garden produce was of the first order, showing a commendable zeal on the part of our farmers, not to be outdone in this department by those of any other.

Our fruit department by far exceeded that of any previous year. Mr. John Currier and Col. Thomas Simmons, of Waldoboro', were the principal exhibitors. Mr. Currier's collection consisting of one hundred, and Col. Simmons' some sixty varieties of fruit. Mr. Currier's exhibition of pears, apples and grapes, we have seldom seen equalled, and never excelled, at any fair we have attended, either State or county. This conclusively proves that these fruits, with proper cultivation and care, can be produced in this as well as in the more favored counties, where the soil and climate are better adapted to their cultivation.

Last, but not least, is the ladies' department, on which the pecuniary success of our fairs are in a great measure dependent. In this department we will not particularize, but only add that, should the same interest be manifested by the members of our local societies in the success of our fairs that is manifested by the ladies in the fitting and filling up of their department, our prosperity would be increased, and the benefits derived from our yearly gatherings greatly enhanced.

The closing exercises of our Fair were enlivened by short addresses by Hon. N. A. Farwell, of Rockland, and Rev. Mr. Tilley, of Jefferson, each portraying in vivid colors the duties and responsibilities of the agriculturist in this great crisis of our country's history.

Our Show and Fair the present year, taken as a whole, fully realized our anticipations, and proved that the beneficial effects of our yearly gatherings are not lost on the farming community.

C. C. Atwell, *Secretary.*

OXFORD COUNTY AGRICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

The Twenty-second Exhibition of this Society was held on the Society's grounds, on the 4th, 5th and 6th days of October, 1864. The first day was devoted principally to receiving entries and arranging articles for exhibition. On the second day the weather was fine and the number of visitors much larger than for several previous years. The third day was not favorable, and consequently the number of visitors was small.

The leading feature of the Show was neat stock, a large collection of which was presented, and it was of a superior quality. Town teams were presented by the farmers of Norway, Paris and Oxford. Herds were entered by A. S. Thayer and Wm. H. Swett, of Paris, and William Hall, Amos T. Holt and John H. Millett, of Norway. Working oxen, beef cattle, stock and milch cows, bulls, steers and heifers were on the ground in liberal numbers. Some were of the Native breed, but the larger portion were a mixture of Native with Durhams, Herefords and Dovons. No evidence was exhibited of their being any full-blooded stock entered.

The number of horses entered was not large, but some good specimens were on the ground. The number of sheep on hand was larger than usual, six flocks being entered for premium.

The Society has offered increased premiums on crops, but it has not produced a corresponding increase of competition for premiums. No entry was made for corn or wheat. There was one entry for barley, one for oats, and one for beans; but no statements have been made by the two latter applicants, and, of course, no premiums were awarded.

The exhibition of fruit was not so large as that of last year, but many beautiful specimens of apples, pears and grapes were to be seen. Improvements continue to be made in this department. Nothwithstanding the diminished crop of apples, the high price at which they sell will amply compensate farmers for all their outlays in this branch of farming; and as the demand is likely to be permanent, it is believed that investments in new orchards would pay good dividends.

The exhibition of dairy products was smaller than usual, but the quality was good. Specimens of domestic manufactures, needlework, &c., were abundant. Bread, honey and preserves were also to be seen on the tables.

The display of vegetables and seeds was large—forty-seven entries of the former and twenty of the latter having been made.

A special meeting of the Society was called in December last, at which it was voted to make an assessment of one dollar on each member, a portion of which has been collected. By means of this, and a favorable time for our Fair, the financial condition of the Society has been improved.

ELLIOT SMITH, *Secretary*.

NORTH PENOBSCOT AGRICULTURAL AND HORTICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

The Annual Show and Fair was held October 12th and 13th at Lee Village. The preparations for exhibition being temporary, they fell short of that convenience and attractiveness possessed by societies whose places of exhibition are permanently established. Yet, considering the very great drain upon our citizen soldiery, nine-tenths of whom are taken from agricultural pursuits, who, unmolested in their calling, are our greatest contributors to the interest and success of our agricultural societies, we deem it but just to say that the Exhibition of this Society has been as well sustained as could reasonably be expected.

Spread over an extensive and sparsely settled territory, the Society labors under disadvantages to which many other and older societies are comparatively strangers. The axe of the pioneer is just giving place to the plow, and temporary fences and buildings to permanent ones, absorbing much of the time of the laborer, which would otherwise be devoted to pursuits yielding a more immediate return. With a very few exceptions, our farms are unprepared for the introduction of many of the labor-saving machines so extensively and effectually used elsewhere. The reaper and mower are strangers, and we are in very deed a people whose living is obtained by "the sweat of the brow."

Yet amid these embarrassments, which require unremitting toil to overcome, we have much to encourage us. Well directed and economical effort always produces a good reward, and by persistent perseverance in well doing, we hope to merit the continued aid of the State so bountifully bestowed, and to increase in knowledge with each recurring year.

Elisha Bradford, of Lee, was awarded four dollars for a full blood Durham—a fine animal.

There was a larger number of sheep present than has been exhibited for a number of years, showing an increased interest in this department of husbandry.

Of dairy products there was a fine display, nearly all the specimens being accompanied by full statements of the *modus operandi*, which rendered this department of greater interest than formerly. A much larger show of fruits and vegetables was made than has been on exhibition at any previous fair for some years.

CROPS. Notwithstanding the severe drought, the crops within the limits of this Society are more abundant than last year.

Hay suffered most from drought, but is of better quality than last year.

Corn, altogether too limited in culture, pays as well as any crop produced.

Wheat. Failures of past years have discouraged many from sowing. Those who have attended to it, sowing early in the season, using the Red Sea variety, have been well paid for their labor. Joseph and Nelson Deering, of Lee, from six bushels sown on five acres of new ground raised one hundred and twenty bushels.

Potatoes. Six weeks before harvest this crop was thought to be a total failure almost. Instead, it is superabundant, not having been so good for years. Thousands and thousands of bushels of a superior quality have been raised, and there is not the least sign of rot.

SHEPARD BEAN, *Secretary*.

WEST PENOBSCOT AGRICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

This Society held its Tenth Annual Cattle Show, Exhibition and Fair at East Corinth, September 27th and 28th, 1864.

The show of neat stock was somewhat diminished in numbers from some former years, but what was wanting in quantity was made up in quality. Pure bred Durhams were exhibited by Hon. Noah Barker, of Corinth, which were stately, fine-looking animals; Jersey, by George W. Jones, of Corinth, and excellent grades were presented by Wait Cheney, Luther Marrow, George W. Jones, of Corinth, and R. B. Smith, of Charleston. A Cotswold buck was exhibited by Israel B. Norcross, of Bangor, and a Spanish Merino by Loring Mower, of Dexter.

The number of horses and colts presented was not up to the usual entry, but those on exhibition were very good. Alfred W. Leavitt, of Kenduskeag, exhibited a beautiful stock horse, nine years old, weighing eleven hundred pounds, of the Drew-Morgan breed.

The fruit department was well represented, showing a gradual increase in the winter varieties. Captain J. P. Sinclair, of Levant, an experienced and successful fruit grower, made a splendid display of apples, pears, grapes and plums. The Committee remark: "In the selection of trees noted for hardiness and bearing qualities among the fall varieties, we notice the Bell's Early, Gravenstein, Sopsovine, Porter and Red Astrachan; and for winter, the English Russet, Black Oxford, Ribstone Pippin and Pecker."

Butter and cheese was excellent, and the show of honey, maple sugar and jellies was very fair.

The exhibition of domestic manufactures, needle-work, paintings and fancy articles was very good, and certify to the industry, skill and ingenuity of the ladies who contributed so much to the pleasure of visitors to the hall by an exhibition of their handiwork.

The limited amount of awards was not considered commensurate to the character of the articles displayed, nearly all of which possessed intrinsic value, and many could hardly be excelled.

Crops compare favorably with former years. E. F. Crane, of Kenduskeag, produced from one acre twenty-four bushels white-bearded wheat, and from another acre two hundred and twenty bushels potatoes. Hall Bagley, of Charleston, produced forty-five and a-half bushels barley from one acre, six hundred and twenty bushels potatoes from three acres, and thirty-one bushels corn from half an acre. Daniel M. Haskell, of Garland, produced fifty-seven and a-half bushels corn from one acre. William Spratt, of Corinth, produced eight hundred bushels (Orono) potatoes from three acres. Asa Shaw, of Exeter, produced two hundred and eighty bushels potatoes from one acre, and from another acre forty-eight bushels corn. E. B. Stackpole, Esq., of Kenduskeag, exhibited thirty-two fine specimens of garden vegetables.

The Fair passed off satisfactorily, and the opinion generally prevailed that our premiums were never more deservedly awarded. Eight new members were added, and a good degree of interest manifested.

T. P. Batchelder, *Secretary*.

PISCATAQUIS COUNTY AGRICULTURAL SOCIETY.

Report of the Secretary.

Hon. S. L. Goodale, Secretary of the Board of Agriculture:

Dear Sir:—I herewith transmit a statement of the success and doings of this Society for the year 1864.

The Annual Show and Fair of this Society was held at Foxcroft, October 5th and 6th, 1864. The weather being very pleasant, there was a larger gathering of the people than usual, and the Exhibition exceeded the expectations of the Society, considering the drought as affecting vegetation, the condition of the stock, crops, fruit, &c.

The horses and colts exhibited were numerous, and very fine specimens of the wonderful improvement made in Maine within a few years in this branch of profitable agriculture. Those of the Black Hawk blood introduced here by P. M. Jeffords, of Foxcroft—horse "Brown Harry"—were most numerous on the ground. There were other breeds of larger size represented, and they might be preferred for service by the farming community, where labor and business is more of an object than speed.

Of working oxen, there were more entries than last year, and they were unusually well matched in size and color.

There were but three entries of bulls, all grade Durhams. They were superior animals, and will aid much in the improvement of stock. The Jeffords' bull, of Foxcroft, and William Arnold's bull, of Dover, received the premiums.

Cows and heifers were thinly represented, though of excellent quality. William McComb, of Foxcroft, exhibited a young Jersey cow, on which was awarded the first premium.

Sheep raising has largely increased in this county within a few years, and very much has been doing for the improvement in breeds. The Spanish Merino take the lead for wool growing purposes, and the Cotswold and South Downs for mutton. There were a less number on exhibition than usual, though some fine specimens of bucks of different breeds were exhibited.

Dairy products. This department, as usual, was well represented, and the specimens of both butter and cheese reflected much credit on the manufacturers, and fully settle the fact that as good butter and cheese are made in Piscataquis as other portions of the State.

Fruit. The show in this department was small, though excellent in kind, evidently showing that we are not behind other counties in the most desirable kinds, though cultivated less extensively.

The exhibition of domestic manufactures and needle-work, paintings, &c., was largely increased from that of last year. Articles manufactured from flax were very respectable in number, and of fine quality.

The Society, at the recommendation of the Board of Agriculture to hold out greater inducements for the cultivation of field crops, concluded to double the premiums, and diminish the quantity of land from former years on wheat, corn and potatoes, and for the entries to be made with the Secretary in May for trial crops, that the result might come from experiment rather than accident. Some four or five farmers complied with the suggestion, but owing to the very heavy and protracted drought during the growing months, no great attainments were made in the quantity of bushels per acre over previous years, yet the results were highly satisfactory for so dry a season.

On the whole, the farmers of Piscataquis and the members of the Society are well satisfied with their festival. With large drafts of men for the army, taken from the industrial pursuits among us, our Society has retained its number by new accessions, thus keeping up our funds equal with former years. The Society owns no ground on which to hold fairs.

And while the past season has been one of unusual anxiety to the husbandman in the scarcity of help, and the severest drought during the summer months ever experienced in this section, there have been hidden blessings and good results in store which come directly from the great Being who has promised both seed-time and harvest.

Of all crops there has been a fair yield. Hay was somewhat less in bulk than last year, but of better quality, and was secured in the best condition and at much less expense by having dry weather. The grain crop suffered most, oats especially, the bulk of straw being very small, while the potato crop has been unusually good, both in size of the tuber and quality of the same. The yield of apples is somewhat less than an average, but the advanced price in the market more than compensates the loss in bushels.

LYMAN LEE, *Secretary.*

SAGADAHOC AGRICULTURAL AND HORTICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

Our Annual Fair for the year 1864 was held on the Society's grounds at Topsham, October 11th, 12th and 13th. The attendance was unusually large for the first two days; the receipts for those days exceeding any previous exhibition. The third day being rainy, the attendance fell off somewhat, causing very general disappointment, although it was very good and exceeded our expectations. There was a great deal of interest manifested by the members and those residing within the limits of the Society, to have a first class Show, and to exceed, if possible, exhibitions of previous years. The limits of our Society are small; and this year we have had much to contend with in the drought which fell so heavily upon us.

The number of entries in the different departments were quite large, and the show of stock very good—much better than was expected; and the quality of our stock is steadily improving. A very good number of horses and colts were exhibited, although the members of our Society do not pay so much attention to that class of stock as they do in some other Societies. There was a fine "Knox" colt on exhibition which commanded considerable attention. I think that we are gradually getting better breeds of horses into some parts of our Society, and more attention is being paid to that class of stock than formerly.

The entries of sheep were more numerous than usual. Many others had flocks which they might have brought, but objected on account of the trouble which it occasioned them. This ought not to be. We should be willing to take a little extra trouble, if we have good breeds, to bring them before the public on such occasions, that we may show what can be done and what we are doing, that others also may be benefitted.

The show of poultry was quite large, and by the way in which it has come into market it shows that considerable was raised.

The exhibition of crops was exceedingly good, as the display in the "Lower Hall" showed. It was better than was anticipated, for the drought had affected us considerably, as it had all other parts of the State, and it was thought that this department would fall short of the average. The display of corn was very good. Potatoes looked fine and large, and the crops of this esculent were represented as much larger than usual; and the varieties of garden produce were very fine. Mammoth squashes, large pumpkins, &c., &c., occupied considerable space. The entries of dairy products were about the same as usual.

The centre of the "Lower Hall" was well filled with agricultural implements, thereby showing that machinery is occupying an important place in the farming interests. Farmers are throwing away their old notions and striving to keep pace with the times.

The "Upper Hall" which is devoted to fruits, household manufactures and miscellaneous articles, was well filled. The Committee of Arrangements had taken especial pains that this part of the building should look well, and, if possible, be attractive. It was handsomely decorated with flags, and the manufactured articles were hung in conspicuous places. The quantity of manufactured articles was quite large, and showed that as much attention had been paid to that department as in former exhibitions.

The display of fruit was very good. Apples and grapes in large variety occupied quite a space, showing that considerable attention is paid to the culture of these fruits.

Naval architecture occupied an unusually large space, showing that our Bath friends were not behindhand in doing their duty. The variety of miscellaneous articles was numerous, and many specimens were well worth seeing.

A fine address was delivered to us by Warren Johnson, A. M., "Principal of the Family School for Boys in Topsham," in which there were many valuable hints for our farmers and farmers' *wives*. He urged the necessity of having an Agricultural College in this State, so that those engaging in farming may be educated up to a proper appreciation and knowledge of their business.

Our grounds have been very much improved. We now have a half-mile course which by competent judges is called the best in the State. We have already had some very fine trotting upon it. Our Society is in a flourishing condition, and the prospects for its future welfare look bright and promising.

ISAAC P. TEBBETTS, *Secretary*.

EAST SOMERSET AGRICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

The East Somerset Agricultural Society held their Annual Cattle Show and Fair at their show grounds in Hartland, September 20th and 21st, 1864. The weather during the two days was fine, and there was a good exhibition of horses and colts. Arnold Palmer, of Palmyra, exhibited a fine stallion of the Drew blood. A stock horse, of the Black Hawk blood, was also entered by B. Miller, of Palmyra.

The show of neat stock was not as large as in some previous years, but I think it was never equalled in quality. S. F. Lyford, of St. Albans, exhibited a full blood Durham bull; James Fuller, of Hartland, a full blood Hereford bull from the herd of J. H. Underwood, of Fayette. One pair of three-year old steers, exhibited by Freeman Holway, of Palmyra, girthed seven feet. They were large and noble animals.

The show of cows was small, all the animals exhibited being grades.

The show of sheep was not as large as in former years. There is quite an interest taken in improving the quality of the flocks. There were full blood Spanish bucks exhibited by Thomas Fuller and John Rowell, of Hartland; also a South Down by Charles Rowell, 2d, of Hartland.

The exhibition of butter and cheese was good considering the season.

In domestic manufactures there was quite a falling off from former years.

The show of fruit was small. The exhibition of field crops was as good as could be expected taking into consideration the severe drought which prevailed in this part of the State. There were several entries of corn, wheat, barley, potatoes, turnips and carrots.

The Society met with quite a loss the past summer, fire burning a part of the fence around their show ground. Consequently, we have reduced the debt of the Society but very little.

THOMAS FULLER, *Secretary.*

WALDO COUNTY AGRICULTURAL SOCIETY.

Report of the Secretary.

Hon. S. L. Goodale, Secretary of the Board of Agriculture:

Dear Sir:—In compliance with your expectations, I herewith present to you a report of the financial condition of Waldo County Agricultural Society, and a brief report of the doings of the same for the year 1864.

The Society has raised by its own influence and exertions seven hundred and seventeen dollars and eighty-five cents ($717.85) during the current year. It received from the State for said year two hundred and fifty-two dollars and forty-one cents ($252.41). It has paid out in premiums four hundred and sixty-two dollars, ($462,) and in incidental expenses three hundred and fifteen dollars and seventy-three cents, ($315.73,) leaving a liquidating fund on hand of one hundred and ninety-three dollars, ($193,) about enough to defray all indebtedness of the Society. The Society's property is worth fifteen hundred dollars, ($1,500,) so that, financially, we are in a prosperous condition.

The Seventeenth Annual Show and Fair of this Society was held on its grounds at Belfast, the 27th, 28th and 29th of September. We had pleasant weather the first day, but an uncomfortable drizzling rain the other two days. We had one hundred and twenty-four entries of stock against ninety-three for last year, and one hundred and sixteen entries in the hall against one hundred and seven last year, so that in this direction, taking into consideration that the feelings and attention of the people were so much absorbed in matters pertaining to the war, we feel that our anticipations have been more than realized. On the whole we are as fully satisfied as ever that this, among the institutions of the day, is doing its good work, and that when "this cruel war is over," and our fine country is once more blessed with peace, and prosperity is stamped upon all her borders, we, as an agricultural society, with our sister societies, will be able to hold our heads high as among the good things of the age in which we live.

T. Thorndike, *Secretary.*

NORTH WALDO AGRICULTURAL SOCIETY.

Report of the Secretary.

The Fourth Annual Show and Fair of the North Waldo Agricultural Society was held at Unity Village, on the 12th and 13th of October. The weather was very fine the first day of the Fair, and the attendance very large. The show of neat stock, though perhaps not as numerous as at some former shows, was fully equal in quality to any ever exhibited by this Society.

The number of horses exhibited was quite large, and some of them very good ones.

There was on exhibition a large number of superior cows.

There were some four or five yards well filled with sheep, besides a large number of bucks of the various breeds raised in this county. The people in this vicinity, as well as in other places, are paying particular attention to the raising of sheep, and find it very profitable with the present high prices of wool and mutton.

The crop department was well represented, and the yield per acre shows that we are not behind other parts of the State in this respect.

There was a large variety of manufactured articles presented.

The show was sadly deficient of agricultural implements.

Although the fruit crop in this section of this State was a very light one, the tables in our hall were well loaded with excellent fruit of almost every variety that our northern climate is capable of producing.

Notwithstanding the second day of the Fair was cold and stormy, there was a large attendance to witness the trial of the speed of horses, in which doubtless many were interested, but which a large portion would willingly dispense with.

E. Murch, *Secretary.*

WASHINGTON COUNTY AGRICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

The leading features of the Annual Exhibition which was held at Pembroke, October 12th and 13th, besides the address of E. H. Balkham, Esq., of Robbinston, upon the subject of "Practical Farming," may be said to have been the display of dairy products, domestic manufactures and fancy articles contributed by the ladies, (all of which were abundant and very fine,) and the array and trial of speed of fast horses. The exhibit of *field crops* and *neat stock* was meagre. The *farmers* were present, but their products and stock were *not* there. It was, in an eminent degree, "A Ladies' Fair and Horse Show." The low premiums offered, distraction of the public mind by frequent calls and drafts for soldiers, and the uncertainty, until late in the season, of there being a Fair, occasioned by the neglect to hold one last year, were causes contributing to this result.

Some ten years ago many members of this Society with a few others, associating themselves together, formed an Agricultural Aid Society which created a new stimulus. Grounds were purchased and fitted up with a trotting course, one half mile in circuit, and the necessary buildings for the accommodation of the exhibitions of this Society. A Black Hawk stallion and Devon bull, of pure breed, were purchased, at a great expense, for the use of the county. Improvements in breed of horses and neat stock have been steadily going on since, which have extended to sheep and swine.

Daniel Fisher, Esq., of Charlotte, writes me as follows upon the condition of the crops, &c., and I make it a part of my report:

"The principal crops raised in the eastern part of the county are *hay, potatoes, barley and oats;* the order in which they are named indicating their comparative value For the last three years the hay crop has been one-third (some say one-half) less than the average for the three years next preceding. This year it has been better in *quality* than the two preceding years, but in *quantity* about the same. Generally, this year, potatoes have yielded better than last year, and more land has been planted with them. The 'rot' has prevailed, varying in different localities, say from five to thirty (and in some cases fifty) per cent. The *grain crop* has been an average yield, with greater breadth of land sown than last year.

The drought, which has extended from Maine to California with more or less severity in different sections, has been the great obstacle here; yet, acting upon the good principle of always looking upon the bright side, we must acknowledge the dry weather was very favorable for cutting and curing the small crop grown, though unfavorable in other respects. A minor obstacle was the great quantity of rain that fell in the month of May, hindering all operations on land not remarkably dry. This probably would not have injured, materially, the crop, had not three months of drought followed.

Much might be said upon the 'condition, wants and prospects of agriculture,' were not time and ability limited. In this district, *at present*, there is more interest felt and more capital employed in agricultural operations, than ever before. The idea is more prevalent and more frequently acted upon, that one acre well dressed is more profitable than two poorly dressed; but the capital is needed to get the dressing. Undoubtedly more systematic effort in saving dressing is wanting. We too much 'despise the day of small things,' and in this matter would do well to take lessons of the Japanese and Chinese.

The practice of buying dressing is becoming common among farmers. Superphosphate of lime, usually applied to hoed crops, is used quite extensively and generally with satisfactory results. The refuse of herring, called 'Fish pumice,' is also much used on farms near the shore. It can be purchased of weir owners for $8.00 per ton, though one year ago it could be had for half that price. For grain it is applied as a top dressing, 500 pounds to the acre. In most cases, if more is used, the grain grows too rank. In one case, four times that quantity was applied, deeply plowed in, with good result, which will, of course, be more lasting. The 'pumice,' properly dried, is fed by some to sheep in winter, and is considered wholesome and economical food.

Sheep husbandry, justly considered the most profitable branch of farm operations, might be much more so, if farmers would pursue the course they acknowledge to be the best, that is, use tillage land only for pastures, changing them from one to another and following them with the plow. Such a course would benefit both land and sheep."

I also transmit the following from the pen of E. H. Balkam, Esq., of Robbinston:

"The most important crops are *hay*, *potatoes*, *oats* and *barley*, in the order here placed. Decidedly the *most* important, not only as being of the greatest real value, but as being necessary to the production of other crops, vital to the interests of the farm, and, other things being equal, the exact measure of the capacity of the fund to produce what are called tillage crops, and to afford the farmer a living business, is the grass crop, and considered in connection with pasturage, before all others combined. The crop of 1864 was probably two-thirds of an average; compared with 1863, not quite as good; with 1862, not as good, (both being years of short crop;) with 1861, (a year of great abundance,) but little more than half as good.

The *greatest* natural obstacle to the culture of this crop, is the prevalence of dry weather in early summer. Next, the repeated freezing and thawing of the surface in winter, and *particularly in* spring. The greatest error, as practiced, is fall-feeding. Nature provides the after growth as a mulch or covering, not only by decomposition to fertilize and promote growth, but to prevent so frequent and (what is of more fatal effect) *rapid* freezing and thawing. We have many instances of bad effects upon vegetable life of frost when drawn out quickly, while the same, extracted slowly, does but little harm. The same result is observable in the freezing and thawing of the flesh of our bodies.

The potato crop has been more abundant than for many years—nearly double that of 1863, yet not entirely free from rot—the better varieties being considerably affected. The rot is to be regarded as the chief and, aside from the fact that care and labor are the price of success with any crop, the only obstacle to the culture of this root.

Oats are something below the average—straw rather short and, in some fields, thin—the grain no more than tolerably filled. It is essential, in most seasons, that oats be sown and come off early to escape rust. Early sowing was impossible in many fields by reason of the wet spring, and the drought of summer retarded growth and prevented filling.

Of barley, owing to the same causes, there was not more than two thirds of a crop. The practice of many is to dress this crop on the surface with green manure which, in dry weather, becomes hard and remains so during the season, affording little nourishment to the crop.

While the tendency of the times is to divert men from farming pursuits, we think the condition of agriculture is slowly yet surely improving. Better crops are being realized from less labor. Farmers are going in for more machine work and more head work, as stupid muscle becomes harder to be got. The methods of cultivation, compared with those of twenty years ago, show marked improvement. Sheep husbandry is engaging more attention, and improved breeds are introduced.

The wants of agriculture are many. An important thing, almost a necessity to the best development of any business, is that it should be taken up as a life business and the faculties concentrated upon that to the exclusion of everything else as an object of pursuit. This is more the case with farming where the operations run through many years and the whole business depends not upon one or ten years, for returns of outlay, but an indefinite length of time. The farmer needs capital. A great deal of our work is done to disadvantage because, for lack of means, things are inconvenient. For the same reason many things are poorly done, when doing them better would produce larger returns. If may be that our farmers are too much afraid of getting in debt. If to use his *own* capital in farming will pay, the use of *borrowed* capital will do the same, provided he pays no more interest than his *own* is worth. Their habits of life make farmers cautious—perhaps over cautious.

Severe labor and good thinking do not go together. Agriculture needs liberal application of the latter. Let the farmer apply it, and not take so much of the former out of his own soul-case, as to unfit him for the more profitable operations of the unthinking part.

Some say "our farms are too large; we cultivate too much." We think they are not large enough. If it will pay to raise one hill of potatoes, to raise two will pay; the second should cost less than the first. A *certain amount* of team is necessary on any farm; on most, the team required to perform common operations, is not worked to half its capacity. The cost of this important item, to do twice as much, would be but little more. The same is true of the more costly implements. The farm buildings would not be proportionately expensive; there would be a saving in fences and family expenses, in taxes also. Where is the farmer who, working alone, does not realize from his labor double the amount he could get by hiring himself out to work at his own occupation? Let him put on more labor at the price he could get if he hired out, and figures tell us he must make a profit, aside from the additional saving alluded to above. Then a want is larger farms, larger operations. We do *not* cultivate too much, though we may not cultivate *well* enough. There is no reason why more may not be done, and *better* done. The farmer, having much to sell, has an advantage of markets over him who has little. He can go further and get better prices. Machinery comes into use and pays better.

That agriculture is everywhere destined to be a moderately paying calling, is undoubtedly true. It must continue to be, what it ever has been in civilized society, the great support of life—that by which communities exist, not individuals get rich; otherwise would be contrary to the nature of things, subversive of good order and dangerous to a proper distribution of useful occupations. Ours is not, and never can be, a rich agricultural region. Still, as our soil has not, in the past, refused "seed to the sower and bread to the eater," the prospect to the *young man* who values health, good neighborhood, social privileges, a chance for the education of a rising family, is quite as good to farm it here as to pitch his tent on a Western prairie, where the luxuriance of nature is too often its own bane. The very fact that our soil is not fertile, drives men among us to pursue other branches of business which, by giving good markets, react favorably upon agriculture. It may look now as if high rates of labor, severe taxation and high tariff were foreshadowing hard times for farmers. But this war must come to an end. Uncle Sam will stop feeding and clothing so many men; yet they must be fed, clothed and sheltered; and those of them who have no other occupation and no homes, must come to the farmer for these things. Business will probably be stagnant, and the farmer will fix the price of labor, while what he produces can not be otherwise than scanty for the wants of the country for many years.

The prospect for engaging in *several* branches of agriculture at this time seems flattering. Fruit raising, always a good operation, offers great inducements. Sheep are picking up fortunes upon our rugged hillsides. Near the coast, the raising of grass and some other crops, by the aid of fish manure, is promising to work wonders. The introduction of machinery is to better our condition. Threshing machines are clattering in almost every village. Mowing machines are to be as common as horse-rakes. The prejudice so long prevalent against them is not as strong as it was against horse-rakes ten years ago. Now everybody rakes with a horse. It will be nearly so in mowing; and not the least improvement will be that *forced one* of making the fields suitable to be mown by machinery. Our prospects, in the noble occupation of dealing with Mother Earth, if not flattering in the extreme, are not such as warrant discouragement."

E. K. SMART, *Secretary.*

WEST WASHINGTON AGRICULTURAL SOCIETY.

The Secretary of this Society, James L. Bucknam, Esq., of Columbia, writes:

"We had the best exhibition of animals and articles at our Fair this year, that we have ever had. I think I may say, and speak within bounds, that the show of neat stock was as good as can be got out east of the Penobscot."

YORK COUNTY AGRICULTURAL SOCIETY.

REPORT OF THE SECRETARY.

The Annual Cattle Show and Fair of this Society was held in Saco and Biddeford on the 11th, 12th and 13th of October, 1864; and by adjournment on account of stormy weather, trots that were arranged to come off on the Society's grounds on the closing day, did not come off till the following week.

This Society, for the past three years, has divided its Cattle Show and Fair—having the Show of stock and trotting, exhibitions of teaming, &c., on their grounds in Saco, and the Fair for agricultural products, miscellaneous and fancy articles, in the City Hall, in Biddeford. This arrangement has proved quite satisfactory generally—the principal objection being the distance to travel in going from one part of the exhibition to the other, (about one mile.)

The weather was good on the opening day of the Fair, and a good, though not large show of stock was driven in. This Society pays *mileage* to stock driven in by distant members in the county, but still fails to get more than scattered contributions from the more distant towns in the county.

The Ayrshires and Devons, among cattle, are now scattered pretty well through this county. Mr. Nathan Dane, Jr., of Kennebunk, has for several years had qnite a stock of very fine Ayrshires, and has done much for this region in improving the breed of cows, by the sale of his young stock to various parts of the county. Mr. David L. Palmer of Buxton, Mr. Oliver Perkins of Kennebunk, and Mr. Elliott Fernald of Parsonsfield, have each had very nice breeding animals of the Devon stock.

The sheep of York county have been improved more in appearance within a few years than any other stock. The average weight of fleeces of wool now yearly taken in the county is, I have no doubt, from one third to one half greater than twenty years ago.

The improved breed that predominates is the Cotswold; and this breed may now be found, mixed or pure, in almost every neighborhood throughout the county. We have to thank Mr. Henry Jordan of Kennebunk, for the introduction of this breed in the county.

Our show in the Hall, on the whole, was very good—some portions rather meagre, while other portions were very fine.

In the vegetable department there was a fair show.

The show of apples was very good—great varieties by Lewis McKenney of Saco, Mr. Everett of Biddeford, and Mr. J. B. Nealley of South Berwick. Show of pears was very good, as was also that of grapes. The produce of grapes has increased very much within a few years in this region, and those exhibited were excellent specimens of the various sorts. They are now considered among the indispensable fruits of a garden, and no wonder, when we consider the luxury afforded by the fruit and the ease of their production. Good crops of plums were raised in this county this season, but they were all gone before the time of the Fair. Some peaches, well grown, were on exhibition, and many more might have been exhibited had the Show come off a week or two earlier.

Several pieces of cloth manufactured from domestic flax were on exhibition. Mrs. Milliken and Mrs. Simpson, both of Saco, had some cloth of this sort that good judges called very nice.

The Cayuga Chief Mowing Machine, exhibited by Messrs. Woodman & Burnham of Biddeford, attracted considerable attention among the farmers present at the exhibition.

The present year proved so successful, financially, that the Society will be able to about close up the balance of its debt, contracted several years since to fit up the track, enclose ground, &c. This Society spent upwards of $3,000 in this way. When the debt is paid larger premiums can be paid, and it is to be hoped greater competition will be awakened in the county, and better Shows be had in the future of our Society.

JOHN HANSCOM, *Secretary.*

AN ADDRESS

Delivered before the Franklin and North Franklin Agricultural Societies, October 5th and 7th, by E. R. French.

In this boasted age of the world's progress when events once supposed possible only in the distorted imaginings of chimerical minds, are really transpiring in our midst; and that which a century since, science in its wildest flights of prophecy would hardly have dared to predict, is already consummated, it is well for the yeomanry of the land to turn their eyes from the blinding glare, the dazzling glory of these great achievements, to consider what is the real state of advancement in that great branch of industry upon which the success of all others depends.

The world's changes are conformable to its history. but nature's laws are fixed both in the animate and inanimate being, and without a general knowledge of those laws, men are liable to run counter to their own interests in arriving at results intended to be realized in the economy of the universe, but which results of themselves are affected in a greater or less degree by the means made use of in their accomplishment. It was decreed unto man on the morning of creation that he should till the land, but it is not recorded that any specific rules or even general principles were laid down whereby he should be governed, yet doubtless it was intended by the Creator that "in the fulness of time" so much of these should be revealed to him as the various circumstances under which he labored should require at his hands.

In its primeval state, the earth was fitted to bring forth and bear fruit; the elements of fertility were evenly distributed through its mould, and the labors of the husbandman were only requisite to sow the seed and gather the harvest, but repeated cropping of the soil produced exhaustion; the equilibrium under which the forces of nature had first acted was destroyed, and it became necessary to resort to artificial means to restore it to its normal condition, or leave it to recuperate its weakened energies by the slow process of fallowing.

In the earlier stages of society before the patriarchs left their roving habits, their tents and their flocks, and dwelt in fixed habitations, the latter was the course pursued, it was not till the inhabitants of the earth had so multiplied as to fill its borders, and title to the soil was secured to its occupant by "meets and bounds," that it became important to restore to the land as a compensation, any part of that which was being constantly removed by cultivation.

The world was a long time in discovering the great principles upon which its security depended; men had not then the light of experience to guide them, and it was only when the sources of their existence began to fail them, that they set about to devise plans to restore the fertility of the soil. In the olden countries, or those first settled by the various races of men, the necessity of this has become so apparent that it is now the thing of primary importance to make suitable restitution for the products the land affords.

Among some nations, as China, Germany, France and England, where population is the densest, they have reached so great perfection in this matter as not only to regain what has been lost, but are improving on the original state of their lands so as to keep pace in a measure with the increased demands for subsistence. China in particular, is an illustration of how great a degree of fertility may be produced, and how vast a population the earth is capable of sustaining when all its sources and resources are properly developed and husbanded. There is room enough yet, even in the old world, if its hill-sides and vales shall be made a fruitful field as were the rugged slopes of Palestine when it marshaled its hosts by thousands.

When the pioneers of the New World landed on its shores, they found its virgin soil up-bearing the giants of the forest, and it would seem that after the experience the old world had acquired, men would have been less prodigal of the treasures of earth centuries had been accumulating, but the same lavish expenditure of vegetable power characterized the husbandry of the early settlers of our country that had impoverished many an ancient domain of the father land.

The bountiful harvests developed the richness of the soil, wonderful indeed to those who had toiled on the worn out lands of their native country, and, as this fruitfulness continued through succeeding generations, the depleting process has gone on until the change, imperceptible at first, has resulted in sterility. Ere this change is fully realized, the newly plowed fields of the prairie regions of the great West are opening up to civilization, vaster resources of agricultural wealth than ever the wooded slopes of the Atlantic afforded, and the rich cream mould that supports the semi-tropical luxuriance of vegetable life covering the great river basins of the western continent must be skimmed off before man will take the sober, second thought, or stay the river to waste.

The tide of emigration that is constantly setting towards the west is only the exodus of the population of the olden States from their partially worn out lands to the more fertile regions in the vicinity of the Father of Waters.

The system of surface culture that has been followed since the discovery of the country has made sad inroads upon the natural resources of the soil, and in too many instances, barrenness has driven the occupants from their lands. There are now large tracts of land in some sections of the country that have resumed their natural state of wildness because of their inability longer to produce remunerative crops.

The natural result of all this is, as has already been stated, emigration, and were it not for the wide way that is always open to us in the new world for enterprise and adventure, we should have been compelled ere this, to have gone back to first principles as they have in the enlightened portions of Europe.

It has been ordered in the economy of nature that nothing that supports material existence shall be lost, and an impartial observance of this great law is sufficient to enable mankind to retain the original types of the soil and even restore that which by blindness or ignorance has been misplaced.

The worn out fields of Virginia and the other pioneer States may regain their wonted fertility when their wants shall be sufficiently understood to know what remedies are required, and how to apply them; nor is it absolutely necessary that the forest should usurp the field in order to accomplish this. The superabundant elements of production that were stored up by the soil when first brought into a state of cultivation have all been brought into requisition, and are now exhausted, hence the falling off that is experienced in many of the crops once producing abundant harvests—harvests that may again be realized under proper culture.

In the New England States the forage crops are considered as first in importance, and our efforts are mainly directed to the production of these, and most farmers do not understand why it is that while we are increasing the amount and value of these, the cereals do not flourish equally well also. The difference of treatment required to produce a grain or a forage crop is as unlike as the results, and in grain growing districts the latter is considered of little account; the point with them being how they shall produce the most and best grain.

It may be asked if a system of culture could not be devised that would secure both the desired ends. Undoubtedly there could, but it must be as varied and combined as the various crops cultivated, and to attain to this end would be the perfection of farming. On newly cleared land we have a practical illustration of high farming, though but a small share of the credit is due to him who raises the crop—the husbandman was before him who garners up. Then the accumulation of leafy mould that has been going on since the acorn sent up its tender shoot, and then the consumption on the ground of the after-growth of centuries, afford abundant food for whatever is raised, and if the soil itself be rich in material this supply continues often through a long series of years. Such were the benefits experienced by the early settlers of our country, and hence the superiority of their crops in quantity and quality over what we now realize, and had they understood properly how to retain in the soil the riches it then possessed, they might have bequeathed a better inheritance to us; but all in turn have been inclined to do as their fathers did, not stopping to inquire if there were a better way, or ought to be a more fruitful field.

It remains for us who have already discovered their error and are experiencing some of the sad results of neglect, to rectify that which was wrong and set about devising means to regain what has been lost. To do this will require a deeper insight into first principles, and a better knowledge of the foundations on which those principles rest. Hitherto observation and experience have been the only guides of the agriculturist, and although a considerable amount of information, useful in practice and establishing many important truths, has been gleaned from the vast field of labor and toil where man by the sweat of his brow gains his daily bread, yet this stock of knowledge is so widely disseminated, recorded only in the sayings and doings of the past generations of men who have handed down to each other their life-long experience, much of it obscurely written among the traditions of the fathers, that an attempt to collect these numerous facts, and reduce them to any thing like a system, would be endless, and hence it devolves upon us of the present age to investigate for ourselves; and whilst we are not to reject what practice has already affirmed, we are expected to apply whatever new truths science develops, and dig deep the foundation for the future.

The ancients had but a limited knowledge of the organic structure and constituent elements of the vegetable kingdom, but reasoning from the analogy of nature, doubtless they early adopted the method of increasing the fertility of the soil by incorporating with it the refuse vegetable and animal matter cast off in the form of animal excrements. This of itself would have been sufficient to preserve its fruitfulness if all that the land at any time produced was consumed upon it, and the waste products carefully re-distributed; but under the various forms in which society has always existed, this was impossible from the very nature of the case.

All these productions that are indigenous to the soil have grown uninterruptedly age after age, subserving their own laws of rotation, without any tiller of the ground save the sun and air, yet their giant forms, their perfection of strength and beauty are in no way diminished, the system of culture that develops the powers of the Universe. Wherever the earth is overrun with its teeming millions, this recompensing system has not been observed, and in the unequal struggle that has been maintained, man's ignorance and cupidity have triumphed over the inherent powers of the earth, which in turn has disinherited him.

Artificial forms of existence require artificial modes of production, and hence arises the necessity for understanding the laws and principles that govern vegetable life.

Whenever we go abroad into the domain of nature, we observe all around us the multitudinous forms of organic life, and recognize at once some mysterious influence that wills and executes its purpose in the annual shrub or century-living oak. We feel it in the exuberant gush of feeling of the spring-time, when bursting buds and opening flowers are breaking the spell that has bound them; we note its dealings by the saddened sympathy of our spirits at the fall of the leaf—'twas the resurrection of life then, 'tis the sleep of nature now—but what this all-pervading principle, we call *vital power*, is, few can answer, none can tell. We may conjecture concerning it, but our conjectures are vacant and incomplete—all are sensible of the unseen power, but more than this is mystery; that which it produced as the result of its magic influence, and that which it brings forth as the bounty of earth is alone cognizable of our senses, and this is probably all the wisdom of man will be able to comprehend of the Divine principle of life.

With no other guide than observation and experience, certain fixed principles have become established in agriculture, and the fact is well known to all that earth, air and water, light and heat are necessary to the development of plant life.

The observing farmer likewise is aware that certain conditions of soil and temperature are peculiarly favorable to the vigorous growth of his various crops, and, on the other hand, he is frequently at a loss to know why, when especial pains have been taken with the preparation of his soil, no better remuneration is obtained.

He recognizes the laws of life that govern his physical being, and he knows some of the rewards and penalties due to their observance and neglect, but the great fact that *law* is the universal sovereign of nature is not admitted in all his practice. Those self-evident truths that have only to be seen to be known, have been his rule of action in nearly all that pertained to his calling, unless we except the traditions of his ancestry chronicled somewhere far back in the past; but in these later days a new light has sprung up; one of the handmaidens of science, whose treasures are both new and old, is the companion of his toil.

If the farmer knows what are the constituent elements of the various crops he cultivates, and the relative proportion which each bears to the other in their different combinations, he is prepared intelligently to minister to the wants in the process of artificial production. These elements are supplied to plants during their growth through the medium of the earth, air and water surrounding them, and in their natural state flourish according to the different localities in which they are found, each species being adapted to its peculiar climate and soil.

The elements of the atmosphere and water are well known and invariable, hence whatever difference is observable in our growing crops is attributable to the difference in the constitution of the soil. The conditions requisite for the successful cultivation of a crop are the same at one time as another and in one locality as another, but the experience of every farmer proves that his success is not uniform. Observation and experience both prove that there is naturally a great difference in soils, and that in the artificial mode of production this difference is increased or diminished in proportion to what is produced and the mode of treatment pursued.

There are four elements in nature so essential to all growing things that they may be aptly called the main pillars of vegetable and animal life. These are *carbon*, *oxygen*, *hydrogen* and *nitrogen*, which in a simple or combined state enter into all the structural forms composing the organic kingdom.

Oxygen and hydrogen combined according to their equivalents make water, nitrogen and oxygen, atmospheric air. Carbon, as carbonic acid, is also supplied from the air, existing in it in a mechanical rather than a chemical state. Nitrogen, though the chief support of vegetation, must first be compounded with hydrogen forming ammonia before it can be of any service as food for plants.

These changes, with many others, all take place in the great laboratory of nature, and produce results as varied as the circumstances of soil and climate admit. Every zone has its fauna, every clime its flora, and we call whatever is produced of the earth spontaneously "indigenous to the soil," but man, in the universal application of all things to his purpose, has not limited himself to the strict construction of natural laws, only as their bounds became impassable.

This is especially the case in agriculture. Every farmer wishes to raise the same kinds and grow the same staples that others do, and does not stop to take into account his facilities for doing so. A great error is committed here, the amount of production is lessened the world over because of the want of adaptation of crops to soil and climate.

We are continually letting go first principles and are striving to be a law unto ourselves in our occupation, but it is impossible for us to remove the old land-marks entirely; we must conform in a measure to surrounding circumstances and be co-laborers with the soil, not task-masters.

Every farmer needs to understand the elementary power exercised by the earth, air and water; and this he may do if he will be an attentive observer and patient scholar in the book of nature. It is for the want of this that our agriculture languishes; it will be by means of this that it will flourish. Our improvements in this matter are to be instantly made. Time must work its changes, men must acquire a habit of investigation, and the deduction of science will then be made available by reducing them to practice. It is not to be presumed that every farmer is to become a chemist in the proper acceptation of the term, neither is it necessary he should in order to successfully prosecute his labors upon the farm. There are many operations daily carried on in the mechanic arts, involving principles highly scientific in their character, but it does not follow that only scientific men are competent to have the oversight and management of these; on the contrary, they are entrusted to men of practical ability whose understanding and judgment have been bent in this particular direction, acquiring a certain degree of knowledge thereby.

So in agriculture; it is a thorough, practical understanding of the matter we want, not fine spun theories technically drawn out; the deductions merely of vegetable or mineral analysis. The disrepute into which so called "book farming" has fallen with many is not that the principles on the theories advanced were founded, were wrong, for they are in the main correct, but because they are mere theories; outlines of designs without the working plans annexed.

The agriculture of the present day is not what it was in the past, neither are its needs the same. Those have increased in proportion as the capabilities of the soil have diminished, and had these increased requirements been duly met, the productiveness of our lands would not have been reduced below their former state.

The principles, for principles they are, deep rooted too, upon which success in farming depends have not changed, but circumstances have, till now the requirements have become imperative. Had the original fertility of the soil been maintained, the necessity that now compels us to investigate never would have been realized, or, rather we might say with equal propriety, had man from the beginning found out all knowledge, necessity might not have existed thereafter.

The experience of the past is our guide for the future. In adversity we are taught some of our most useful lessons. Strictly speaking, nature is not exhausted, her inherent powers still exist, but their relative proportions have been changed and will for the time being be inactive till the harmony is restored.

The requirements made upon the agriculturist of the present day who successfully prosecutes his labors, are multiform and various, and oblige him to call into action other powers than physical force. The cure-all prescriptions of quacks in agriculture will never restore the soil to its original type, and while the farmer should guard against imposition, he should endeavor to investigate the causes that operate against successful culture. The theories that are advanced by scientific men are generally correct as theories, but nevertheless are not always to be relied on. In a country diversified in surface and soil like our New England farms, almost every case needs a separate investigation, and it is properly the business of every farmer to be thoroughly acquainted with the character and characteristics of the soil he cultivates.

Professional agriculturists rarely extend their observations, so as to balance correctly all the counter influences that are likely to modify a theory however well-founded, they work from certain general principles that are admitted or assumed, or, perhaps have become fixed through the application of general laws.

These theories are important to us as aids in developing the sources and resources of agricultural wealth, but it is too often the case with men ever ready to adopt something new that they overlook or are unacquainted with the general principles upon which their theory depends, and which principles alone are of general application.

Every intelligent farmer is aware of the constitutional differences existing among soils, and has some particular method of culture which he deems to be most appropriate to each locality. Herein lies the great secret of success in farming, but I have only stated the fact on general terms, to apply it is quite another thing, and to possess the secret still another step in advance; a rule or an exception to some rule or principle.

The causes which have operated to create and maintain those differences are generally apparent, and ought to be understood by every man whose occupation requires him to recognize first principles as his chief guide. The river bottoms of the west bear but slight resemblance to the prairies, although the causes which formed the two are doubtless similar, but while one is referred to an indefinitely remote period and local changes, the other is of present date and affected according to the region from where the sedimentary deposits are obtained.

With us this diversity is still more distinctly marked, and we have less difficulty in pointing out the changes which have taken place. The fertile valleys that lie embedded among the hills are nursed by the frost and storm that are *weathering* our hills and mountains, but these disintegrated, crumbling rocks must first pay tribute to the grassy slopes that have upborne them ere they can enrich the plain. Every farmer can tell by observation whether any or all these circumstances affect him, and it must be equally plain that all unfruitfulness is not attributable to the same cause.

One man's crop may fail at one stage of its growth, another's at another. With one, some particular crop is his staple; with another, almost its counterpart flourishes best, and even in the failure of the same or similar crops the same elements may not be lacking in the soil to bring to maturity, but some that are equally essential to a vigorous development.

The same methods of cultivation are not to be pursued indiscriminately without reference to the character of our lands, and here again theorists are at variance. The advocates of deep plowing believe it to be the great specific of worn out lands, and this reasoning is, to say the least, plausible and generally admissible, yet there are lands in which the practice would be destructive to vegetation in the extreme.

This matter requires us to investigate still further the geological structure of the surface and subsoils. In some localities the substrata is a barren sand, in others, a poisonous oxide, and in either case if large quantities of this material are brought to the surface, the sickly existence of vegetation protests against the practice. Little by little must such soils be exposed to the neutralizing influence of sun, showers and air before they can be made subservient to vegetable growth. There are soils so peculiar in their composition that at first they nourish and afterwards destroy the nutritive forces that at first cause a vigorous growth, being finally overcome by the virulent oxides that underlie them.

Some of the richest soils we have are unproductive in their natural state; but correct their acidity and neutralize their noxious salts, and their productiveness is astonishing. A soil possessed of only one kind of earth is barren, no matter how valuable that element may be of itself. The same is true of purely vegetable matter; no single elementary substance can supply to growing things all the functions of their existence, and unless there are stimulants enough to call into action her *endosmose* or *internal impulse*, animating the unseen forces that build up the structural forms of the vegetable world, the whole is inactive.

Sufficient consideration is not given to the "native habitat" of plants whenever it is attempted to remove them from their natal soil and accustom them to situations and circumstances widely differing from their original state. Plants indigenous to the sea-shore must be fed with salt inland, and aquatic plants droop in the dry mould. The wide spreading palm of the plain is not found on the mountain's crest, and the lichens under Lapland snows would be a withered thing beneath a genial sun. The insectivorous and vegetable forms of parasitic life that war with the immature crops on our old grain fields are enemies of culture that must be archly contended with, and the investigation of the functions of life peculiar to them, the circumstances of soil and atmosphere that favor their production, are subjects that afford opportunity for extended observation and patient research.

The rust that affects our grain, and the rot that destroys our potatoes, are now well ascertained to be species of *fungus*, induced by certain conditions and circumstances dependent on the constitution of the young plants at some stages of their growth.

There are certain peculiarities attending the destruction of the wheat midge and Hessian fly as yet not well defined, their migratory and periodic character affording room for almost endless speculation as to their habits and the causes affecting their development.

When the minutiæ characterizing the indefinite existence of vegetable and animal parasites shall be fully explained, we may hope to cope successfully with these adversaries, but till then we must be satisfied to labor, investigate and wait the report of progress.

There is no stage or state of development in agriculture but that it affords topics worthy to engage the attention of the naturalist and scholar; and he whose lot it is to till the soil ought so to conduct his labors and improve his opportunities, that he may feel a consciousness within himself that *he* is "nature's nobleman," one of the "lords of creation." Too many who claim to be farmers are beneath their calling—mere human machinery, pursuing their labors automaton-like year after year, and from one generation to another.

In the present reduced state of our farming, something more is necessary than to plant and sow, and reap and mow, and wait for the incoming harvest; the land has paid tribute till its title alone remains, and in many cases the forest again asserts its right to redeem it from sterility.

The requirements of the past have too rarely been met, consequently the demands of the present and future are proportionally increased, nay, imperative, and are not to be put off. The successful farmer of to-day labors with his hands, and his head, and his heart, and is looked upon as the representative man of his species.

The tone of society has undergone a material change within a few years, and farming as an occupation gains a reputation. It has obtained character likewise by the reforms inaugurated on the farm—the amelioration of its life-long toil by combining the amenities of labor with its necessities.

The man who tills his own broad acres, and in his daily toil reflects the light and experience of all ages, is in all respects the peer of him who stands in the forum, or buys and sells for gain in the marts of commerce.

Had necessity never been known, there would have been no opportunity, and no progress would ever been perceptible, but with want came the demand, and with demand the supply till nature is satisfied.

In our agriculture we are to observe the same great principles, the same immutable laws that govern the universe of material and immaterial forms, animate and inanimate existencies, and "if it is ever to be restored to its pristine rank, and a new Eden is to bloom with its fruitful fields, it must be by bringing the Godlike attributes of men to the task of renovation."

Upon you young men and you young women who do or are to walk together in the journey of life will this labor devolve. Bring back the old homesteads to their former fertility. Heighten the charm of years around which so many memories cluster; build new homes on these hillsides and in these valleys; improve every spot of earth where art can add to nature, till field and wood, and rugged steep and quiet nook each in its turn shall be a thing of beauty in the ever-varying scenes of nature's panorama. The farmer's life ought not to be all toil. Let pleasure and recreation mingle with it; let a refined and cultivated taste adorn our dwellings and sweeten our affections. Build no castellated mansions, whose choicest rooms shall stand in cold, sepulchral state, but homes in which our children shall grow up amid the amenities of life as well as its labors. I love, when winding among these hills, along these streams and through these vales, to picture the future of our land, and especially of New England. The traveller abroad lingers not around the mouths of the Rhine, where its sluggish waters lazily wind through the deep-sea bottoms of the low countries, but hastens on to the picturesque Alps, where its hurrying current sweeps round jutting crags or slows in green and quiet valleys, and the hamlet on the hillside and the cottage in the vale give an indescribable charm to the landscape. So will it be with our New England. The tide of emigration will not be forever westward; the limit will eventually be reached, when the wave of population will roll back over us, and we be as is central Europe now. Let us anticipate it.

Through this thick war-cloud there shines a bright and glorious future—the hope of the old nations, the destiny of the new. Let the yeomanry of the land rise up to meet the day at its breaking. Let the love of home and the love of country be twin passions in our breasts, and the sentiment of each be, as he looks over his paternal acres, "I love these rocks and rills, these woods and templed hills." *I love New England.* They cannot leave us out in the cold. We will keep a warm home-fire burning on our hearthstones; by our firesides we will renew the ancient hospitality, and our boast shall be, forever be, that we dwell where, from shore to shore, from sea to sea, the star-spangled banner waves o'er the land of the free, the home of the brave.

INTRODUCTION TO THE CHEMISTRY OF PRACTICAL FARMING.

BY THOMAS DYKE ACKLAND, JR.

From the Journal of the Bath and West of England Society of Agriculture, Vol. III, 1864.

INTRODUCTION.

First, let me say what agricultural chemistry will not do: it will not teach farming; farming is an art, and, like all other arts, it must be learned by practice. One of the greatest ancient philosophers said in a treatise on morals, a man can only become virtuous by doing good actions, just as a man can only become a shoemaker by making shoes. So, to understand farming, a man must farm; there is no other way. Fortunately for the younger part of my audience, there is no improvement in farming, with the single exception of the use of steam-power, which a young man cannot study in full practical operation under men of energy and experience in this neighborhood.

Our fields are well drained, the land is clean, the crops are abundant, the live stock well bred, artificial manure and food are freely used, and our implements, which were the weakest point, are rapidly improving. It has frequently happened to me, after noticing some good practice in another county which was new to me, to find on coming home that my practical neighbors were beforehand with me. I allude to such practices as autumn cleaning of stubbles, forking out couch, &c. I might also refer to the fact that a practical form of box-feeding was in operation here long before Mr. Warnes's day. In such matters the farmer is a better teacher than the professor, because his practical habits of business enable him to judge whether an improvement will pay or not. It is on sound judgment on that point, on a knowledge of our own climate and good marketing habits, that success in farming depends, as a money question, more than on abstract scientific knowledge.

But there is one point on which those who know most about farming will admit the imperfection of their knowledge, and that is the rational explanation of their own practice; they know that one plan answers and another does not, but they are often at a loss to say why. Now it must surely raise even a day-laborer in the scale of intelligent beings, and give him nobler pleasures, if he can go about his usual employment not merely as a task to be got over, but if he can trace the hand of his Maker in the wonderful processes of nature. He will not merely submit to the stern laws of nature, and accept the bountiful gifts she brings him, without seeing any connection between them; but every walk he takes in his fields and every book he reads will bring more food for his mind and his heart than before. All, then, which I propose on this occasion is to endeavor to contribute to your enjoyment as observant and thinking beings by throwing some light on the daily occupations in which you are engaged, as far as they admit of an explanation on chemical principles. I must leave it to you to judge how far, if at all, these principles are in accordance with existing practices, and how far they admit of any new practical application.

PRACTICE AND SCIENCE—WHEREIN THEY DIFFER.

Before, however, I can explain what agricultural chemistry is, I wish to make a remark on the difference between a practical and scientific way of looking at things.

The practical man and the philosopher both desire to *get at the truth,* but for different ends. The practical man is he whose business it is to make or do something. He is always acting, and can spare little time for thinking, except for some object close at hand; on most points he has made up his mind, and cannot go over the whole ground again, or if he does he must come to a decision quickly, act upon it at once, and wait the result perhaps for a year. The consequence of this is that his powers of observation are very much sharpened in a certain way, but he is obliged to look at facts in the rough, and generally without much classification or arrangement, for which, in fact, his previous education has rarely fitted him.

The man of science, on the other hand, aims at knowing rather than at doing; his great concern with results is to find out their causes; he tries not to produce effects, but to account for them. This he does first by accumulating and arranging in his head the knowledge of other men of various ages and lands; secondly, by taking up some one point on which little is known and working it gradually out. It is especially his duty to be content to bide his time, to observe individual facts very minutely one at a time and under special conditions, to follow each principle out to its consequences, and to be very cautious in drawing practical conclusions.

It follows that owing to the fact that the farmer and philosopher travel by different roads they do not always give the same account of the country they pass through.

The farmer, being engaged in a struggle with varying seasons, has a lively sense of the obstacles to be overcome, and is an acute observer of common elements of success or failure to a degree which often surprises learned professors. The philosopher looks at facts under assumed and artificial conditions, quite rightly for his proper work, but he sometimes forgets this in applying his knowledge to practical life. He has a tendency to over-estimate possibilities, to calculate expense at a minimum, produce at a maximum: the man of the field calculates by averages, with a wide margin for seasons and bad luck.

But though there be this great difference in their way of dealing with facts, the very difference of their employments shows that they may assist each other, because each has opportunities which the other has not; and, in fact, the leading men in each department have of late years acquired a thorough respect for the judgment of those in the other, when exercised on points falling within their own province. I think farmers are now generally disposed to look for help from science; but they are perhaps not yet fully aware of the amount of laborious, patient toil involved in one honest investigation upon a theoretical point. When I tell you that many analyses take two or three weeks' work of men of first-rate ability, and that a conscientious chemist will begin his work all over again if he spills a single drop containing far less than the 1000th part of a grain of the substance under examination, you may form some idea of the amount of work locked up in some thousands of analyses made by men of European reputation during the last half century. Yet on how few subjects in practical agriculture do they yet venture to speak positively!

AGRICULTURAL CHEMISTRY—ITS RELATIONS TO OTHER KNOWLEDGE.

Agricultural science, speaking generally, has for its object to ascertain the laws of Nature which regulate the growth of vegetables and animals when they are artificially produced. By these laws the tiller of the soil is inevitably bound; and he must try to understand them, if he hopes to modify them, as his Creator allows him to do, by labor and skill. Science, in fact, points out to practice its limits and conditions, and at the same time suggests to it fresh hopes and new inducements to exertion.

Agricultural chemistry is, of course, but one branch of a much larger subject. Before we can understand the laws by which living things grow, we must accurately know the laws of lifeless matter, or matter in general; of that dust whence our own bodies were taken, and to which they will return.

The properties of matter are of two different kinds. In the first and simplest case, bodies or substances act upon each other only by pressure or change of place, remaining in other respects as they were before. The properties so called into action are called *mechanical;* such, for instance, is the action of frost on clods of earth, of sand and clay when mixed; and generally we may say that the direct action of tillage on soil is mechanical. But in the second case, different substances have peculiar properties of their own; and these different substances, when brought together under suitable circumstances, undergo peculiar alterations, and exchange the properties which they had previously for new properties. For instance, why does iron rust? Because a portion of air and of water has united with the iron, altered its properties, and actually increased its weight, instead of wasting some of it away to nothing. Why does limestone in the kiln lose half its weight, and become quicklime? and why does quicklime again become mild and gain weight again by exposure to the air? Simply because certain changes have taken place between the lime and the air under the influence of heat and moisture. In like manner, when cider ferments, and bodies putrefy, changes are going on between different substances of which the bodies are composed. These changes are the consequences of *chemical* properties; the bodies are said to react upon each other, whence the term chemical re-agents is applied to the tests by which one substance is known from another.

It is of the greatest consequence in all inquiries into the science of farming to keep clearly in mind the distinction between mechanical action and chemical action; and it is not less important to bear in mind that, besides these two causes for the effects we observe, there is a third, which is that mysterious agency of which we know so little—Life. Its operation we call, for want of a better name, *vital force.* Thus you will see that there are three departments of inquiry bearing on the whole of the science of agriculture:

Vital action, of which the science is Physiology;
Chemical action; and
Mechanical action, treated of by Natural Philosophy.

Chemistry stands between and touches on the borders of Physiology on the one hand and of Natural Philosophy on the other, inasmuch as many of the processes which go on in the interior of animals and plants are explained on chemical principles; and, on the other hand, chemical forces are frequently intermixed with those which are merely mechanical. These three sciences are in fact the master-keys opening the way to all the more special branches of natural knowledge, and to all accurate acquaintance with the principles of Arts and Manufactures, and what is commonly called Agricultural Chemistry, treating as it does of the inert soil, of powerful chemical manures, and of the food of plants and animals, has a special reference to the principles of all three, namely, Natural Philosophy, General Chemistry, and Physiology.

A few words must now be added on the objects aimed at in chemical inquiries, and on the principles involved in them.

THE OBJECT OF CHEMISTRY.—THE ELEMENTS.

One of the principal objects of chemistry is to ascertain the different constituent parts of which bodies are made.

In ancient times it used to be supposed that all things were formed from what were called the four elements—earth, water, air, and fire. We know now that each of these four is a compound of simple substances, and though it is not uncommon to hear the ancients ridiculed for their imperfect knowledge of nature, this division of theirs is not at all to be despised. Earth, water, and air represent to us the three states in which many things may be made to exist, namely—the solid state, the liquid state, and the state of vapor or gas. Water, for instance, may be made solid by cold, and turned into vapor by heat. The same effects may be produced on quicksilver and on several other common substances.

Before, then, we enter upon the inquiry "What materials are animals and vegetables formed from? and how are these large solid masses of living beings accumulated, and again resolved apparently into nothing?" I must make one demand on your thinking powers. Can you conceive that what is called a gas need not be a thing by itself which is always a gas? But are you prepared to believe that the same quantity of matter, the same particles ascertained by weight on the scale-beam, may appear sometimes as a gas, sometimes as a liquid, and sometimes as a solid? and that this change of state, to speak generally, depends simply on the fact that the particles of matter are expanded or moved farther apart from each other by the action of heat? and that on the removal of the heat they may be condensed or brought nearer together either by pressure, that is, by squeezing, or by the mutual attraction of one for another? Different kinds of attraction there may be, but we need not enter into that question here.

Every one has heard, for instance, of the oxygen of the air, which is commonly called oxygen gas, and which used to be called "*vital air*," as opposed to "fixed air." It is that part of the air which our bodies require to draw in through the lungs, and without a supply of which life would instantly cease; a supply of it is also necessary to keep a fire or candle burning. But oxygen is also a part of water. A gallon of water weighs 10 lbs.: throw away one-tenth part, or 1 lb.; of the remaining 9 lbs. exactly 8 lbs. are oxygen. There is also oxygen in rusty iron or iron ore, and in the ores of many metals. The oxygen is there in a solid state, and, as I said before, adds considerably to the weight of the pure metal, instead of wasting it away and making it lighter. In fact, oxygen is in the state of a gas in our breath, in the state of a liquid in our blood, in the state of a solid in our bones. It pervades all nature, animate and inanimate: the solid earth, the tossing ocean, and the elastic atmosphere.

You will therefore, I trust, not set me down for a wild theorist if I try to prove to you, by-and-by, that the greater part of the produce of your farms comes out of the air; and in the meantime perhaps you will be entertained by the following account of yourselves, given by an eminent chemist:

"Science has demonstrated that man, the being who performs all these wonders, is formed of condensed air (or solidified and liquified gases); that he lives on condensed as well as uncondensed air, and clothes himself in condensed air; that he prepares his food by means of condensed air, and by means of the same agent moves the heaviest weights with the velocity of the wind.

But the strangest part of the matter is that thousands of these tabernacles formed of condensed air, and going on two legs, occasionally, and on account of the production and supply of those forms of condensed air which they require for food and clothing, or on account of their honor and, destroy each other in pitched battles by means of condensed air."

We may assume it to be now admitted that earth, water, and air are not elements, but compounds in certain states, *i. e.*, more or less compressed or expanded, whether by mechanical or chemical forces. The efforts of modern chemists have been, in great measure, directed to the work of decomposing or splitting up all bodies in their true elements: that is, to find out substances with special properties, yet so simple that they cannot be divided again into simpler substances, and this is all which is meant by an element, namely, that it is a well-defined substance, and that, in the present state of chemistry, man is unable to decompose it, or to prove it to be compounded of other substances.

In order to gain a really sound knowledge of chemistry it is necessary to study the characteristic features of every element separately, and then to learn the laws by which they enter into combination with each other. This cannot be done by reading a book, nor even by listening to a lecture. Practical chemistry is like practical farming. The student, who is in earnest, must go to work at it in a laboratory, which means a place of work, and he will learn more by following up his own blunders than by the most lucid teaching of the professor.

The chemist has to put two questions to every body which he examines: 1. Of what parts is it composed? 2. How do these parts combine together and act on each other? From these two questions results two different modes of studying chemistry, which I may illustrate in this way. If you wanted to make one of your sons an engineer or mechanic, you might either show him a piece of mechanism at work, and let him pull it to pieces, or you might give him each of the parts separately, explain their respective uses, and teach him to make a new machine. So in chemistry you may take each separate element, possessing well-defined and peculiar properties which chemists have been unable to break up into simpler substances; you may study all these properties in detail, and their action on all other bodies, building up one compound after another, from the simplest to the most complex. This is called the synthetical method, or synthesis, which means putting things together. It is the process of the child, when it puts letters together to form words, and words to form sentences. It is also the process of the mathematician, who rears on the basis of a few simple definitions and axioms his gigantic superstructure. It is, in fact, the proper way to master an accurate science thoroughly, and therefore the proper way to study Chemistry.

But where the object is to interest the practical man, rather than to train and educate the man of science, it may be more suitable to take the common things around us, which are all highly complicated in their chemical structure, and pull them to pieces, that is, trace them backwards to the simplest parts of which they are composed. This is called the analytical method of treatment, or analysis.

But what is analysis? The word means simply to unloose, or to resolve a whole into its parts. Let me give you one or two simple instances. When wheat has to be prepared for market it is first threshed, that is, the corn is loosened from the ear by beating. If you use one of the beautiful combined thrashing-machines, you at the same time separate your crop into the several portions of straw, chaff, tailings, and best corn. This separation is *mechanical* analysis ; you divide your crop by mechanical forces alone.

Take the case of milk. You first separate the cream from the skim-milk. In Devonshire you scald the milk in order to loosen the hold which the curdy matter has on the buttery part, and you so far analyze the milk by separating the butter with the aid of heat, and complete the process mechanically in the churn ; but the cheese-maker does more ; by the use of rennet she introduces a very delicate chemical process, by means of which she renders the curd insoluble, and separates it from the whey. These simple processes of the dairy are, in fact, a specimen of chemical analysis. They are not, of course, exact enough for scientific requirements, but they serve to illustrate the meaning of an operation so often talked of.

I propose, then, instead of commencing in the usual way with a description of the elements separately, to bring before you a few of the common products of the farm, just in the form in which you meet with them, and to show you that they consist of certain substances easily distinguished one from another, and how these substances are to be recognized both in animals and vegetables ; we shall then inquire whether these substances are not themselves compounded of simpler elements, and endeavor to trace them to their origin. Having thus, as I hope, given you something like a tangible notion of the various substances necessary to the growth of your farm produce, I shall show, in a practical form, what substances are removed from a farm in the ordinary course of English farming, and how they are to be replaced; and, in dealing with this part of the subject, I shall have to give you some account of the connection between science and practice established by some leading members of the Royal Agricultural Society of England.

And now allow me on this occasion instead of *Agricultural Chemistry* to use the term *Chemistry of Practical Farming.* There may not be much difference; but I wish to show that my object is not to bring practice to be judged of by science, but to draw science out of practice. We will begin with the common sorts of agricultural produce.

THE DIFFERENT KINDS OF FOOD PRODUCED ON A FARM.

The three principal products of a farm are meat, dairy produce and corn. Let us, then, take them in succession, and after some simple fashion analyse them; only we must learn as we go on a little accuracy in such matters. It will be enough to state, in a general way, that the products of the farm belong to the animal and vegetable kingdoms; and it is a part of our most familiar knowledge that animal life is supported directly or indirectly by vegetables, while vegetables in some sense or other are sustained by the earth, the rain, and the air; thus the mineral kingdom furnishes the elements out of which vegetables are built up, and the vegetables supply the food of animals. This is the chemistry of nature; man cannot imitate her in the marvellous processes of life; in dealing with the products of life he can only undo her work by pulling it to pieces.

We begin, then, at the highest point with the animal. We will take as the type of the highest form of organization in farm produce a full-grown and well-fed sheep, certainly not the least important article on the farm either to the producer or the consumer, furnishing, as it does, the most nourishing and wholesome food, warm clothing, and light.

The most obvious divisions of the sheep's carcase are bone, lean flesh, fat, wool, besides the skin, sinews and other matters yielding size and glue; nor must we forget the blood which conveys the food, after it has been digested, to all parts of the body, and therefore contains all the materials out of which the body is formed.

Component parts of an Animal. If you look at the annexed table you will see the parts of a sheep arranged in three principal divisions: at the head of the first column is fat, at the head of the second flesh, and of the third bone.* You will not fail to recognize the following distinctions. Fat, after it has been boiled down and separated from the greaves, is pure tallow, and may be entirely burnt away, leaving no ashes behind. Flesh is more difficult to burn; and if you burn it in a clean dish you will find a certain residue of mineral matter in the form of ashes. Bone—by which I mean dry bone, after all the grease and glue have been removed—may be heated red hot, but, when cool, remains of the same weight as it was before being heated, without being consumed.

TABLE I.—*Showing the Simplest Division of Substances raised for Food of Man on a Farm.*

	A.	E.	O.
MEAT, . . .	Fat, ...	Flesh (lean) . .	Bone (quite dry.)
MILK, . . .	Butter, ...	Cheese (skim) .	Mineral ashes.
WHEAT, . .	Starch, ...	Gluten	Ditto.
Distinctive characteristics of each part,	Easily burn quite away. Do not putrefy. Do not give off ammonia.	Do not easily burn. Do putrefy. Do give off ammonia.	Do not burn at all. Do not putrefy. Do not give off ammonia.

Another set of distinctions may be noticed, founded on the tendency to putrefaction. Fat, that is, pure tallow, may be kept for an indefinite time; it may become rancid, but it will not putrefy. Flesh cannot be kept, except by excluding it from the air or by salting; but in its natural state soon putrefies, gives out offensive smells, and disappears, all but a small residue. A familiar illustration of this distinction may be given in the case of potted meat, which is preserved from putrefaction by a coating of fat, on which the air will not act. This distinction is owing to the connection between flesh and ammonia, which is very volatile. Putrefaction or decomposition easily ensues in any substance which is capable of generating ammonia. We shall see that in this last point is involved a principle of immense importance to the farmer, in regard to the economy of the food of animals and the food of plants. Bone will not putrefy after the glue has been taken out of it.

---

* The columns are marked with the letters A, E, O, being the vowels of the three words fat, flesh, bone, and this distinction will be observed in other tables to assist the memory.

Component parts of Milk. We will next take milk, the type of perfect food, being, in fact, that fluid from which alone young animals derive their fat, flesh and bone, in the early period of their growth. The parts of milk may be arranged in the same manner as those of the animal. First, we have *butter*, which, if quite pure (for common butter contains a mixture of cheesy matter), will entirely burn away like oil; it will not putrefy by exposure to the air, that is, it will not soon disappear, though it may turn rancid and become disagreeable in taste. There is also a certain quantity of sugar in milk, which is characterized by the same tendency not to putrefy. Secondly, we have *cheesy matter*, which, under the influence of moisture, will putrefy, and which burns slowly and with difficulty, giving out a smell of burnt hair or ammonia. And, lastly, the whey, which, when entirely freed from butter, sugar and cheese, and evaporated, will leave a considerable portion of dry mineral matter which is not combustible. The quantity of the ashes so left is about ½ per cent. Ten gallons of milk contain about ½ lb. weight of solid mineral matter, which cannot be burnt away.

Component parts of Wheat. We will presently trace these several classes of food to their origin, through the grass, hay, turnips, &c., consumed by the animal; but, first, let us look at one other essential article of food, the staff of life, used by civilized man in the form of bread. If you grind up wheat, and knead the flour up in plenty of water for a considerable time, in fact, as long as the water has a milky appearance, you will separate it into two parts. The turbid milky water contains starch, which will be deposited when it settles, and the dough which remains, after all the milky substance has been washed out of it, will be a tough, elastic, transparent mass, which, from its sticky nature, is called gluten. The proportion of this gluten varies as much as from 10 per cent. to 20 per cent. in different samples of wheat, the difference depending, among other conditions, on the climate or season in which the wheat is grown. The starch which has settled down from the milky liquid is more than half of the weight of the whole grain. There is also a small proportion of mineral matter in wheat, which cannot be burnt away, and will be left in the form of ashes.

On looking now at the results which are stated in the table, it is impossible not to be struck by the fact of the remarkable likeness subsisting between the three principal sources of human food, which will appear more striking when we have considered the following question:

WHAT ARE THE USES OF EACH KIND OF FOOD?

The necessity for food arises from the constant waste which is going on in all animal bodies. Of this waste there are two causes, breathing and moving, or, in other words, the respiration of the lungs and the exertion of the muscles. The action of breathing is similar to that which goes on in the fireplace, or in the burning of a candle. Our lungs are the fireplace:* we draw in fresh air through the windpipe, and when we give out our breath we send forth not the same fresh air that we drew in, but an air which is not unlike that which goes up the chimney from a clear-burning fire. And there is good reason for believing that by this action of the breath the animal heat is kept up. But, as the fire cannot be kept alive without wood or coal and fresh air, so our lungs cannot act unless we have a supply of food fit to burn and fresh air to burn it with. Speaking very roughly, a strong healthy man burns in his lungs daily an amount of fuel equal to about ¾ lb. of coal.† The other cause of demand for food is the exertion of muscular force. It is supposed that, every time we move our limbs or any part of our body, a certain change takes place in the substance of which they are composed, and that this change involves a waste of the flesh or muscle by which the force is exerted: the tissues so used up passed off from the body in various ways, and are replaced by those materials of food which possess the requisite composition.

From this short statement, then, you will plainly see that there are two great purposes to be fulfilled by our food—the supply of heat and the support of force. Now, then, if you will look again at the table, you will see that the three descriptions of food there exhibited in the first column—viz., fat, butter, and starch—are all eminently fitted for combustion or keeping up the animal warmth. Whereas the three substances in the second column are distinguished from those in the first by not being easily burnt or decomposed. The fact is that animal force is entirely exercised by lean flesh or muscle; and it is a very remarkable fact that cheese (skim cheese, not rich Stilton) in the case of milk, and the gluten in the case of the bread, are composed of exactly the same materials as lean flesh.

---

* The statement in the text may not be strictly accurate; but it would require too much chemical detail to explain the process by which it is now supposed that heat is generated and diffused throughout the whole body.

† 1 lb. of coal will heat 56½ lbs. of water from 32° to 212°, that is, from the freezing to the boiling point.

Of the *bone* it is not necessary to say more here than to point out to you that the constituents of bone are contained in milk and bread: they are carried by the blood about the body wherever required, and in some cases bone is absorbed again and cast out of the body.

I cannot refrain from pointing out to you the wonderful providential arrangement thus disclosed to us by the knowledge of these facts. The laboring man, who is constantly in motion, requires food which will support the waste of muscular fibre, and this is afforded by the common cheese made of skim-milk; and it so happens that butter being, in some degree, an article of luxury, the demand for it among those in easy circumstances is such that its price is enhanced; and in consequence of this higher price of butter the dairyman is able to sell common cheese at a lower rate to the working-man. I have ascertained, by conversation with several working-men, that their own experience bears out this statement. One very active man told me that he believed he could work better on common cheese than on flesh meat. It is nevertheless true that fat, such as bacon, is also a valuable element in food for hard-working men; this partly results from its use in keeping up the animal heat, partly because, as I am informed by medical men, it aids in digesting other food.

CLASSIFICATION OF THE MATERIALS OF FOOD.

Before we trace the different kinds of food, as gradually developed in practical agriculture, we must take another step in analyzing them, and endeavor to *ascertain and classify the materials of which they are made*, and then we shall be better able to trace them to their source.

i. *Meat and Vegetables contain Water.* If we take a piece of meat or almost any part of a vegetable and subject it in a dry vessel to a heat equal to that of boiling water, but not higher, it will be found to lose some of its weight; and if this warming be carried on in a covered glass vessel it will be seen that steam is passing off, which may be all collected and condensed into water. That this is true of liquids, such as blood and milk, will be obvious. But it will perhaps be somewhat surprising that there is about the same quantity of water in lean flesh as there is in blood; water exists to a large extent in pure cheese and in wheaten flour, and to a still larger extent in turnips, cabbages and grass. With regard to the oily matters, such as butter and fat, they will not be found when pure to give off water in the form of steam at the temperature of boiling water. Animal fats, however, do contain an appreciable amount of the elements of water, but not in the same proportion as that in which they are contained in water; and one of the causes why they burn as they do is the tendency of their elements, in contact with air, to form water again among other products of combustion in its true proportions; in effecting this union an intense chemical action takes place attended by the phenomena of heat and light; and this is what we mean by combustion, namely, chemical union attended by light and heat.

ii. *Animals and Vegetables contain Carbon.* When by the process of drying to the heat of boiling water we have removed whatever water we can so separate, we may next subject the meat or the dry flour of wheat to a higher degree of heat in a thin glass vessel over a spirit-lamp, taking care, however, to exclude the air. This is called charring, or dry distillation; you will observe that the meat or the grain now changes color; it becomes roasted. What, then, is this dark, black substance?

There is also another way in which we may produce a similar appearance. It is well known that if a drop of vitriol fall on a linen garment or on a piece of wood, it will char it or turn it black: what has happened? Vitriol has a most intense thirst for water. It has therefore a strong drying effect, like that of lime, which dries up what comes in contact with it. Only the vitriol acts still more intensely. The vitriol then has dried up all the water; what, then, is the black substance which is left? If you see these effects of charring on a piece of wood, you will not hesitate at once to pronounce the black mass to be charcoal. Well, just as it is charcoal in wood, so is it charcoal in every other vegetable substance, and in the flesh and bones and fat of animals; the black crust of your loaf of bread is charcoal; the blackened skin of an overdone piece of meat or of a milky pudding is charcoal; and now, if you please, we will give it its proper scientific name, which is *carbon.*—See Table II., column A.

iii. *Some parts of Animals and Vegetables contain Nitrogen.* In charring animal and vegetable matters you will not fail to notice the distinction already pointed out, that the bodies in column A of Table I., give off no smell of burnt hair or ammonia, that those in column E do give out such a smell; we may as well now place in the same class with the lean flesh there mentioned all matters which yield glue, such as skin, cartilage, gelatin of bones, and also wool, which has a character of its own. Wherever this smell of burnt hair takes place, we may infer the existence of a body called nitrogen or azote—an element which invariably enters into lean flesh or muscle, and which it is therefore absolutely essential should be found in the food which supports the action of the muscles and repairs the waste which they are subject to. From the names of this body we derive a distinction which is now very common in works on the science of farming. Fat, butter, sugar, starch are called *non-nitrogenous* or *non-azotized* bodies; while flesh, cheese, and gluten are said to be *nitrogenous* or *azotized.* It may be well also to repeat here that whenever putrefaction takes place ammonia is formed. Ammonia is a compound body, of which about four-fifths are nitrogen. The nitrogen in living bodies having only a feeble affinity for the bodies with which it is there combined, and having a strong tendency to pass into the state of ammonia, as soon as vital force ceases, ammonia is rapidly formed and flies off as a gas; the most offensive smell of putrefying substances is owing to another gas formed with sulphur, and well known as the smell of rotten eggs.—See Table II, column E.

iv. *Some parts of Animals and Vegetables contain Earthy Matters.*—In addition to the elements which we have found [viz., water, carbon, and nitrogen], the animal system always contains two elements, well known as sulphur and phosphorus; these are to be found in those parts of an animal which are in the column E, and also in the curd of milk and the gluten of wheat. If we carry the action of heat one step farther, and burn the meat and wheat in the open air, they will gradually consume away till nothing is left except a small amount of ashes, and in these ashes we shall find, in addition to the elements already named, viz., Phosphorus and Sulphur, which form powerful acids, the following earthy or mineral matters:

1. Potash and soda, commonly called alkalies.
2. Lime and magnesia, called alkaline earths.
3. Iron, which is always present in the blood.

These bodies enter into combination with various acids, of which they are the corresponding bases: as for instance, gypsum consists of a combination of sulphuric acid and lime, and is therefore called sulphate of lime. A large part of our bones consists of phosphoric acid in combination with lime and magnesia, called therefore phosphate of lime and phosphate of magnesia.—See Table II, column O.

These ashes of mineral and earthy matter may appear insignificant, but, small as they are, in proportion to the bulk of the bodies in which they are found, they are of the highest importance. A great part of the theory and practice of manuring depends upon them. Certain very small quantities of them are essential to the health of animals and plants; and however abundantly other fertilizers may be supplied, if any one mineral element which the plants or the animals require is inadequately supplied, they sicken and die.

The proportions of the different component parts of blood, and also of meat, milk, and wheat, classified under the four heads just enumerated, are given in the following Table:

TABLE II.—*Showing the Percentage of Constituents of Blood and Food of Man.*

		A. Non-Azotized or Non-Nitrogenous.	E. Azotized or Nitrogenous.	O. Mineral.	Authority.
Blood . . .	Water 78.0	Pure fat 0.3	Albumen, &c. . 7.0 Coloring matter . 13.0	Carbonates, Chlorides, &c. 1.0	Fownes.
Flesh of ox . .	Water 77.0	Fat all supposed to be removed.	Albumen, fibrin, &c. 19.7	Saline matter . 2.0	Johnston.
Bone (fresh) .	Water 12.0	Fat 8.0	Gelatin, &c. . 24.0	Mineral . . . 46.0	Voelcker.
" (dry) . .	. . . . . .	Fat all removed	Gelatin 35.0	Phosphates . . 58.0 Carbonates, &c. 7.0	Johnston, p. 1013.
Milk (cow's) .	Water 87.3	Butter 3.0 Sugar 4.4	Cheese or casein . 4.8	Phosphates . . 0.3 Other ash . . 0.2	Haidlen, quoted by Fownes, p. 552.
Wheat—reckoning	Water—	Starch—	Gluten, Albumen, &c.—		
Flour 5-6ths	In flour 13.3	In fine French flour . . 58.5 In coarse Odessa . . 50.0	In flour . . 10.0	Ash—about . . 2.0	Compiled from various authorities.—See Johnston, 871, &c.
Bran 1-6th	In bran 2.5	Oil in bran . . . . . 0.8 Husk, &c., ... 9.0	In bran . . 3.4		

ELEMENTARY SUBSTANCES: WHENCE AND HOW SUPPLIED?

Having ascertained some of the chief substances of which animals and vegetables are made, we proceed now to ask where do these substances come from, and how do they enter into the composition of the living individual?

First, as regards animals. Within a very few years it has been clearly made out that the chief constituents of the animal frame are prepared ready made in the vegetable. By a series of laborious investigations chemists have established the fact that the white of egg, a substance found also in the blood, and to which, on account of its white color, they give the name of albumen, is almost identical in its composition with the substance of which lean meat chiefly consists, and also with casein, or curd of the milk, and with the gluten of the wheat. It is now generally admitted that the animal receives the substance of his muscle ready prepared into his system from his vegetable food; and those constituents of food which supply the material of muscle and flesh are commonly known by the name *albuminous*, albumen being taken as the type of the group.

With regard to fat, it has been shown that a considerable amount of oily or fatty matter exists in common vegetable food. Chemists have also traced a series of beautiful transformations, by which vegetable fibre is shown to pass into starch, starch into gum, and gum into sugar. All these substances consist of the same elements, yet how various their characters, how important their uses! The rich sweetness of the grape or the apple is thus matured through a gradual ripening from the original formation of vegetable tissue, and this vegetable tissue originally consisted of nothing *but carbon and the elements of water*; nor has any new substance been added. The constituents of food in this group are often called *carbonaceous*, to distinguish them from the nitrogenous or albuminous group.

We need not here enter upon the question how far the vital power of animals may effect changes in their food (a very difficult subject); it is sufficient to have noticed the fact that the principal substances of which animal bodies are composed are also to be found in vegetables ready prepared for their use; and further, that some of the processes of cookery effect changes similar to those which take place in the interior of animals, and so save time in the feeding process.

The animal thus derives the substance of its tissues from vegetables, and these substances, or the elements of them, previously existed in vegetable compounds. I have prepared Table III, to show the proportions in which the different nourishing principles are contained in the articles of food commonly given to animals, namely, grass, roots, grain and linseed-cake; it is arranged under the same general heads as Table II.

The tables make no pretension to scientific accuracy, and though I have generally indicated the source from which I have obtained the figures, I have done so rather to give others the power of correcting my statements than to claim any authority for them. It is very difficult to reduce such calculations to a common standard. Still less do I put these figures before you as a guide in practice. I only wish to point out to you the conclusions arrived at by the investigations of chemists in the laboratory, and to excite you to inquire further into the matter in the field and the stall. I am convinced that much expensive food passes through animals which is never recovered again in the manure. Every effort should be made to prevent this waste, by more accurate study of the component parts of the food and by testing their actual effects on animals. The practical application to be made of this table will be more apparent as the reader proceeds. Perhaps he will then take the trouble, if he thinks it worth while, to turn back to the explanation, which I put in the form of a note in order not to interrupt the course of the argument at present.

TABLE III.—*Showing the Percentage of Constituents of Food of Live Stock.*

	Water.	A. Carbonaceaus or Non-Nitrogenous.			E. Nitrogenous or Albuminous.	O. Mineral.	Authority.
		Producing Fat or Heat.		Indigestible.	Producing Flesh.		
		Ready-made Fat.	Starch, Gum, Sugar, &c.	Woody Fibre.	Albumen, Casein, &c.	Ashes or Salts.	
GRASS.							
Natural	70 0	1.0	13.0	10.0	3.0	2.0	Averages from, Way, R. A. S. J., xiv. 171.
Water-meadow	79.0	0.7	8.0	5.0	4.0	2.0	
Artificial (April)	87.6	0.8	8.9	3.1	3.2	1.3	
Ditto, 2d crop (June)	74.5	0.5	11.2	8.7	2.7	2.2	
ROOTS.							
Turnips	90.0	0.2	6.9	1.9	0.3	0.7	Way and Johnston? in Heming's Tables.
Bulb, Norfolk Bell	92.2	2.1		2.8	1.2	1.0	Voelcker, in Morton's 'Cyclopædia of Agriculture.'
Swede	89.5	4.6		3,8	1-4	0.6	
Tops, Norfolk Bell	91.2	0.6		4.0	2.4	1.5	
Swede	88.0	1.6		5.0	2.0	2.2	
Mongold	86.0	11.2			1.8	1.0	Voelcker.
Potatoes	75.0	0.3	18.0	4.0	2.0	1.0 about	Johnston, p. 962.
Parsnip	82.0	0.5	7.3	8.0	1.2	1.0	Voelcker.
Carrot	87.0	0.2	8.0	3.4	0.7	0.7	
GRAIN.							
Oats	12.0	6.0	50.0	15.0	14.0	3.0	Average from numerous analyses. Voelcker.
Beans	14.0	1.4	43.0		19.7	2.65	Way, R. A. S. J., x. 495.
Peas	14.9	1.29	47.0		21.4	2.34	
Linseed	10.6	34.7	.	.	28.0	3.5	
Linseed cake (mean of many analyses)	7.0 to 8.0	American 11.4 French 9.0 English 13.5	Not determined		Average 27.0	American 6.35 French 7.9 English 7.3	Way, R. A, S. J., x. 479.

Secondly, as to the elementary substances of vegetables.—We have seen that vegetables contain water, carbon, and nitrogen, besides some mineral matters; our next inquiry is, from what sources are these substances derived by the plant?

It is a very common, and certainly not an unnatural, opinion that our crops derive their nourishment from the accumulation of vegetable matter in the soil, or, as it commonly called in Devonshire, in the meat-earth. Some persons also have been led by what they have seen in books about the elements of carbon and nitrogen, to form a hasty conclusion that plants can imbibe carbon directly from charcoal as a manure; others think that as there is a large amount of nitrogen in the air they can derive the nitrogen from the atmosphere, by absorbing it in its uncombined state through their leaves. Both of these theoretical opinions are considered by competent authorities to be at variance with facts. Again, there was a theory about humus which was very popular a few years ago. It was found that there were in the earth certain acids containing carbon, to which various names, such as humic, ulmic, and others were given, and it was too hastily inferred that they were absorbed by the plant and carried vegetable matter ready formed into its juices.

This theory is now abandoned by most English chemists. It is now supposed that plants derive the supplies of the two principal elements of their structure, their carbon namely and their nitrogen, chiefly from two sources. These sources are *carbonic acid* and *ammonia*, both of which can be absorbed in water, and when so absorbed they can be imbibed by plants through their roots in union with water as a liquid, and through the leaves in union with water as a vapour. I have spoken several times of the elements of water; one of the elements of water united with carbon forms carbonic acid; the other united with nitrogen forms ammonia. I am now to show you that both carbonic acid and ammonia are accessible to plants, and are to be found in sufficient quantity, either in the soil or in the atmosphere, to supply all our agricultural requirements.

WHAT IS CARBONIC ACID?

One of the most familiar forms in which carbonic accid occurs is in the bubbles which escape during the fermentation of beer or cider; it is sometimes called foul air; it is heavier than common air, and lies at the bottom of large vats: it is that air which is well known to be inconsistent with animal life, and which often extinguishes a candle let down into a closed well. The air which we breathe out of our lungs contains much carbonic acid; the hot air which rises from a candle is chiefly carbonic acid; so that all the pure air in this room would in a short time be turned into carbonic acid and be unfit to breathe if fresh air were not constantly admitted. Half of the weight of common limestone is carbonic acid; it is this which is displaced by heat in the limekiln; or it may be displaced by adding a stronger acid to lime which will take its place in union with the lime, and then the carbonic acid which was in the solid stone, having nothing to detain it, makes its escape in effervescence, that is, bubbles of gas rapidly expanding.

We may say, wherever limestone is decomposed, wherever fuel is burnt, wherever animals breathe, or wherever fermentation takes place, during all decay of animals or vegetables, the supply of this gas is going on; and when I remind you that 35 millions of tons of coals are supposed to be annually raised in this country and to be dispersed throughout the air, you will change your question and ask, not how can plants be formed out of the air, but how can such inconceivable quantities of unwholsome gas be poured forth every year and yet the world be a fit place for man to live in?

The answer opens to us one of those marvellous vistas through which it has been vouchsafed to us to look into the works of the Almighty. It is quite true that, if a special provision had not been made, the atmosphere would long since have been unfit for respiration; but every green field, every forest, even the mighty submarine groves of the ocean, are perpetually refreshing the atmosphere with pure air, taking out of the atmosphere the carbon, and reconverting the carbonic acid into pure vital air.

A few words on the growth of plants will put this in a clear point of view.

Vegetables generally act in this way. Each of their seeds contains in itself an embryo plant, which, under the influence of heat and moisture, swells and pushes out a root downwards, and either one or two seed-leaves upwards; the food of these seed-leaves was ready formed in the seed; through these roots and leaves carbonic acid is imbibed for the stem; but as we all know in the case of the turnip, if the seed-leaf is destroyed before the rough leaf is formed the plant dies; as soon as the stem and its leaves grow the plant sucks up water containing carbonic acid from the earth; this passes into the leaves, which are furnished with delicate mouths on the underside; through these little mouths, under the influence of heat, evaporation of the water takes place, and a still more peculiar influence of light causes the carbonic acid to be decomposed; the solid part, the carbon, is thus locked up or deposited in the leaf, the little mouths give out the pure air, to which we may now give its proper name, oxygen. Carbonic acid consists of carbon and oxygen; animals draw in oxygen, unite it to carbon, and breathe out carbonic acid. Plants do just the reverse, they draw in carbonic acid, decompose it, retain the carbon, and give out the oxygen; so is the balance of nature maintained.

WHAT IS AMMONIA?

Ammonia used to be best known by the name of volatile alkali; it is met with in the form of the liquid salvolatile, which is a solution of ammonia, just as a bottle of soda-water is often no more than common water charged with carbonic acid or fixed air; the ammonia itself is extremely volatile, and therefore it easily takes the form of a gas, and escapes unless kept closely corked up. It was originally made in Egypt from the droppings of camels, and derived its name from a district of that country many centuries ago. In Europe it used to be made from horn, whence it derived the name of hartshorn; and it is now made in commerce by the distillation of all sorts of animal refuse. Large quantities are also made in the process of gas-making. Such are the various sources from which the volatile alkali or ammonia of commerce is derived. It is combined (according to the process of manufacture) with various acids, which give the different names of carbonate of ammonia, sulphate of ammonia, and muriate of ammonia, which last is the same as salammoniac, the original Egyptian product. The form, however, of ammonia, which is at present most important to the farmer, is that which is to be found in the urine of animals. The urine is separated from the blood, and carries off all the waste of the muscular tissues which has been replaced by food. The solid excrements only carry off the undigested surplus matters which the system does not require to take up. Except, therefore, in the case of animals highly fed, little ammonia is formed in the solid matter of dung, but a great deal in the liquid. Lastly, wherever putrefaction takes place ammonia is formed, and from its volatile nature it immediately escapes into the air unless it is detained by some special arrangement for the purpose.

This ammonia, whether it is found in the form of a volatile gas, of a liquid solution, or of a solid crystalline salt, always contains that substance which is found in lean flesh, in cheese, and in gluten, and to which the name of azote or nitrogen is given. In 17 parts by weight of ammonia 14 parts are always nitrogen. From what has been said of putrefying bodies, and of the excrements of animals, it is obvious that a constant escape of ammonia must be going on, and therefore that there must be a certain quantity of it diffused through the atmosphere. For some time the amount of this substance in the air escaped all available chemical tests; but we owe its detection to the acuteness of Liebig.

The Elements of Water.

Having now ascertained that plants may derive a supply of carbon from carbonic acid, and of nitrogen from ammonia, and that both of these gases are diffused through the atmosphere, it may be well to state the intimate relation which water bears to carbonic acid and ammonia.

Carbonic acid consists of carbon in union with *oxygen;* ammonia consists of nitrogen or azote in union with another substance called *hydrogen.* It is remarkable that these two bodies, oxygen and hydrogen, are the elements of water, united in the proportion of 8 lbs. of oxygen to 1 lb. of hydrogen, which, so combined, form 9 lbs. of pure water. You will not then wonder that water is capable of dissolving carbonic acid and ammonia. In fact, these gases diffused through the atmosphere are closely connected with the steam or vapor which the air contains; and when this vapor is condensed into clouds, and falls in rain, the water brings down from the heavens the substances which plants are chiefly made of, in the only state in which they are supposed to be capable of receiving nourishment into their circulation. It is also deserving of your notice that water charged with carbonic acid or with ammonia has a power of dissolving some of the ingredients of the soil which are necessary to the existence and health of plants, thereby bringing them, as Dr. Daubeny has observed, from a dormant into an active state.

The Mineral Matter of Plants.

This brings us to the last part of plants, the mineral matter which they contain in addition to the elements already spoken of. The four elements of which we have spoken, namely, carbon, oxygen, nitrogen, and hydrogen, are called *organic* elements, because the organs, or regularly organized parts of plants, are chiefly composed of them; the mineral matter which remains after the organic matter has been burnt away, that is, converted back again into gases, this mineral matter is called the *inorganic* part, because the plant is then disorganized or reduced to its mineral elements, that is, to a shapeless heap of ashes.

The quantity of mineral matter, or ashes, to be found in the same part of the same species of plant, does not vary much. For instance, there will be one proportion of ash in the grain of wheat, and another in the straw; and one proportion in barley grain, another in wheat grain; but neither the quantity nor the composition of the ashes in the different individual plants of each species will vary much. We also find certain kinds of mineral always present in certain plants in greater abundance than in others, *e. g.*, potash in cabbage and potatoes, flint or silica in wheat straw.

We are therefore justified in concluding that particular minerals are essential to particular plants, and that, if by a long course of cropping with the same plant we exhaust the soil of that essential mineral, the plant will not thrive. But of this more hereafter. Only let it be here observed, that we do not thereby prove that a full supply of all essential minerals will make a plant thrive, but only that it cannot do without them.

The chemistry of farming should explain the laws which regulate the supply of these minerals from the soil, and the conditions according to which the feeding or absorbing power acts in the plant.

The practical questions for the farmer to have answered are, which of these minerals he may safely rely upon his soil for supplying; how he should manage the soil so that it may readily yield them up; and what materials he must purchase and add in the form of manure.

The principal kinds of mineral food required by plants are soda, potash, lime, flint, phosphorus, and sulphur; and these minerals are found in the state of salts. In order to enter into the chemistry of agriculture it is desirable to have a clear idea of the general principles of salts; but it would interrupt us too much to go far into this subject at present. It will suffice to give a few instances. The mineral part of our bones consists chiefly of two remarkable salts—carbonate of lime, which is the same thing as common chalk or limestone before it is burnt, and phosphate of lime. If we analyze carbonate of lime we divide it into two parts, carbonic acid and pure lime, or quicklime; we either drive out the carbonic acid in the kiln by heat, and leave the quicklime, or we pour a strong acid on the limestone, which divorces the union between the lime and the carbonic acid, displaces the acid gas and joins itself to the lime, and so makes a new salt: this new salt will be sulphate of lime if we use sulphuric acid, and muriate of lime if we use muriatic acid. The phosphate of lime in plants is a salt formed by the union of phosphoric acid and lime. In like manner nitrate of soda is a salt, consisting of nitric acid and soda; gypsum is the salt already named, consisting of sulphuric acid and lime, called therefore sulphate of lime. Another instance of a salt is carbonate of ammonia, formed by the union of carbonic acid and ammonia, of which so much has been said.

There are two points to be especially noticed; 1st, that when an acid unites with a base, it ceases to have acid properties; and the base, which was an alkali, ceases to have alkaline properties. The properties of the salt are neither those of an acid nor those of an alkali, but distinct from both. For a common instance, we may take gypsum or plaster of Paris, which has not the caustic properties of either vitriol or quicklime, of which it is composed.

2d. These properties of acids and bases neutralize each other in fixed proportions, and every acid and every alkali has its own proportionate value, which holds good in reference to every other substance in the world. 40 lbs. of sulphuric acid will balance 17 lbs. of ammonia, or 28 lbs. of lime, or 48 lbs. of potash. In like manner, 28 lbs. of lime will balance 22 lbs. of carbonic acid, or 36 lbs. of phosphoric acid: lime, potash, or soda, will, in like manner, balance in certain fixed proportions any of the numerous vegetable acids to be found in plants, which are so important to us in food and in medicine; such as citric acid, tartaric acid in grapes, malic acid in apples. On the other hand, some of the most active principles of plants are vegetable alkalies; such, for instance, are quinine, morphine, strychnine (a dreadful poison), caffeine or theine, the principles of tea and coffee. These are all found in combination with various acids in the plants, and therefore exist in them as salts. On the understanding of this wonderful balance of nature depends the comprehension of the first principle of all decomposition, of fermentation, of manuring, and of the building up again of the fabric of the plant and of the animal. All nature around us has a tendency to restore its balance by the re-union of these conflicting elements: man is permitted for his own use to decompose the compounds of nature, and to make fresh compounds of his own; but if he leaves things to themselves Nature restores the balance in her own way. This is the true meaning of the common saying, that quicklime has lost its nature when we have left it exposed to the air: the carbonic acid of the air has again united with the quicklime, and brought it back to the state of mild lime.

So much, then, must suffice on this occasion on the theory of salts, and of their composition. But the practical consequences involved in the constitution of salts deserve a moment's attention. It follows that a great variety of changes may be going on in the soil and in the manures which we use. In most soils there is an abundant store of minerals, which if well managed, may be gradually made available to plants,—if ill managed, may be either locked up in an inert state, or washed away by rain. In like manner some of the elements of manure are volatile, and will soon escape in the absence of the precautions needed to fix them, that is, to retain them in a liquid or solid state. But the proper economy of these materials depends on a practical application of the properties of salts, which may be either volatile or fixed, either soluble or insoluble, according to the chemical proportions in which they may happen to be combined, or to the circumstances under which they may be allowed to decompose.

If it be really true that the great bulk of plants, their woody fibre or carbon, and also their nitrogen, so essential to the nutrition of animals, can be derived from the air, does not it follow that we have only to analyze the soil and find out what mineral matters are deficient, supply them, and leave air and rain and sun to do the rest? or, to state the question more definitely, is it practically true that, if we supply to plants the inorganic matters which we find them to require, they will supply themselves with the organic matters from the atmosphere?

Liebig answers boldly in his "Familiar Letters," that "the produce of our fields will increase or diminish in a direct ratio with the supply of mineral elements capable of assimilation." And again, "if an artificial supply of ammonia is not given, they can obtain all the required supply of nitrogen from the atmosphere."

This is the famous mineral theory, most important if true; but the whole grand jury of English farmers, if they could be empannelled, would give its verdict "not proven."

Liebig is so confident in the truth of his theory, that he regards its practical application as merely a work of time.

"The problem in agriculture, at the present day, is no longer to seek for proofs of this truth, which no man of science doubts, but the grand object is to substitute for farm-yard manure that universal food of plants, its elements obtained from other and cheaper sources, retaining its full efficacy; and this can only be done when we shall have learned, what as yet we know but imperfectly, how to give to an artificial mixture of the individual ingredients the mechanical form and chemical qualities essential to their reception and to their nutritive action on the plant; for without this form they cannot perfectly supply the place of farm yard manure. All our labors must be devoted to the attainment of this important object."

I do not propose to detain you by discussing the theoretical arguments of the great chemist, I would only observe in passing, that even if we decline, with a smile, the advice of some of the professor's followers, that we should burn our dungheaps and apply only the ashes, let us not be too sure that the laugh will be all on our side. There are plenty of farmers now alive who laughed at guano, and thought they could never be brought to believe that a basketful of dust could do the work of a cart-load of the old black stuff. It is impossible to predict what fruit principles fairly worked out may lead to some day; at any rate, farmers owe a great deal to Liebig for teaching the reason for their own good farming, and putting them in the way to farm much more cheaply than their fathers did.

But we must bid farewell for the present to the illustrious German, and look at practice by the light of English chemistry, carried out on a large scale in the open field.

FARMERS NOT TO EXPECT TOO MUCH FROM CHEMISTRY.—WHY?

The practical questions which, I believe, many farmers want answered, are these: Can I find, by analyzing plants, what food they want? and can I, by analyzing my soil, find out in what it is deficient, and give my orders to my manure merchant accordingly, and so reduce my expenses and save the interest of my capital by buying only so much of each article as my plants may annually require?

If these questions could be answered simply in the affirmative, farming would be reduced to a simple calculation, as sure as mathematics, and we might expect to see senior wranglers coming forth as first-rate farmers; or, at any rate, farming could be reduced to the same simple rules as any other manufacture. Now, not to mention the vicissitude of seasons, which affects all calculations of a business which has to be conducted in the open air, there are two reasons of a definite kind why the simple affirmative cannot be given to the farmer's questions above propounded.

1st. The difficulty of detecting, by chemical analysis of soils, the causes of their fertility. 2dly. The imperfection of our knowledge as the processes of life in plants, or as to what is called the physiology of plants. As to the first point, the analysis of soils, we know by practice that when a soil is what we call exhausted, if we attempt to grow a crop without manure it will not pay. We know also that the addition of say 3 cwt. of guano will, in many cases, make all the difference between a good and a bad crop. And yet, if a chemist were to analyze the soil before and after the application of the guano, it is very doubtful whether he would be able to detect its presence. For consider, an acre of soil, taken at the depth of an ordinary ploughing, cannot be estimated at less than 1,500,000 lbs., allowing each cubic yard to weigh a ton; 3 cwt. of guano would contain (at 17 per cent.) about 50 lbs of ammonia; the chemist therefore has to detect one part in 300,000, or the percentage of ammonia would be increased by 0.0003 by the dressing.

This small percentage is practically far too minute for the most delicate modes of analysis to estimate with certainty for practical purposes. The same reasoning would apply to many of the other mineral elements removed by crops in small quantities. I wish to lay stress on this point, because I believe that some intelligent men, who desire to bring chemistry to bear on farming, have formed expectations from analysis of soils which can only lead to disappointment.

2dly. As to the physiology of plants. Any one who has examined the modern books on Botany, such as those of Dr. Lindley for instance, cannot fail to be struck with the vast amount of minute and laborious investigation which has been bestowed by men of the very highest abilities and industry on every subject relating to the growth of plants. The scales of the chemist, and the microscope of the botanist, vie with each other in aiding the search into the wonderful workings of life; and yet one cannot but feel how very little is absolutely known of the state in which plants take their food, and of the way in which they assimilate it. Still more must we admit how little we are able to estimate and explain the circumstances which regulate the development of each part of the plant; the practical experience and ingenuity of the gardener have far outstripped the theory which tries to account for his acts, and just so it is in farming. We want different plants for the sake of different parts, corn crops for their seed, forage crops for their leaf, and the turnip for its root: and to a certain extent we have found the means of turning the laws of nature to our account; but of the agencies by which the living plant prepares for us our corn, our grass, and roots, we know little; and therefore how to obtain more grain, how to stiffen the straw, by what management we can avert the smut, the rust, and the mildew, are questions which all practical men ask, but the man who knows most about science is slow to give a positive answer, and the reason is the imperfection of our knowledge as to the food and growth of plants.

For these two reasons, then, the imperfect powers of analysis and imperfect knowledge of the laws of living things, we cannot at present reduce farming to the simple question of supplying to plants what they take out of the soil.

It is not, however, by any means useless to ask what is removed from the soil in the ordinary course of farming. And to this subject let us next turn our attentive consideration.

WHAT DO CROPS REMOVE FROM THE LAND?

The gross weight of vegetable produce raised on an acre of good land managed on the four-course system, will be, in the course of four years, about 40 tons in round numbers, of which about four-fifths will be water; leaving, in round numbers, about 19,000 lbs., or say 8 tons, of organic matter, and about 1,300 lbs. of inorganic matter or ashes, which would be left if all the crops of the four seasons were burnt. Let us look at these materials a little more in detail, but without going into any more particulars than will serve to give a practical illustration of the question of manures. The organic matter, as you will remember, is that which is capable of being burnt away, of which carbon and nitrogen were the two parts which most engaged our attention. It was asserted that they were united with the elements of water in carbonic acid and ammonia, and in those forms imbibed by the plant.

The four years' crop will be found to contain about 9,000 lbs. of carbon and about 3 cwt. of nitrogen. The carbon is about equally divided between the corn crops and the green crops, but the nitrogen is divided in the proportion of 1 cwt. to the corn crops and 2 cwt. to the roots and grass. I beg your particular attention to this fact; you will see presently that it leads to a practical conclusion exactly the reverse of what you would expect.

Now let us look at the mineral constituents. Is it not at first sight a surprising fact that the whole of that part of four years' crops which is not combustible should amount to less than one cart-load of ashes? Of these mineral elements I will only mention a few which are supposed to be most important in manure. Foremost of all come phosphate of lime and potash, because they are often scarce in soils of average quality. Moreover, the amount of potash required by plants is considerable, and it is a very expensive mineral to purchase as a separate article of commerce. Flint or silica is essential to the stalk of wheat, being that on which its stiffness depends. The other elements, such as soda, magnesia, iron, sulphur, and common salt, are either insignificant in point of amount, or are generally found in average soils in sufficient quantities.

The four years' crops will contain, then, about 100 lbs. of phosphoric acid, or 2 cwt. of phosphate of lime, about 3 cwt. of potash, which, together with about 2 cwt. of lime, and between 2 and 3 cwt. of sand and silica, will account for more than two-thirds of the whole of the mineral matter. I beg you also to observe that the turnip crop only contains about one-fourth part of the phosphate of lime, the grain of the wheat and barley containing nearly half of it. It may be well to mention in passing that if we had taken other root crops instead of turnips, there would have been a difference in the proportion of some of the elements. For instance: mangold would have increased the amount of salt; potatoes, carrots, and parsnips, require a large amount of potash; the last two rather increase the percentage of lime.

So much of these facts as bears on the question of practical manuring is set forth in the following Table, which is prepared from various sources, but chiefly from Mr. Heming's Tables in the Royal Agricultural Society's Journal, No. xxx. p. 435, &c. Round numbers are in all cases taken, and some are assumed, the only intention being to bring under one view a rough division of the constituents of crops, for the purpose of showing, — 1, how much is obtained from the atmosphere; 2, how much is lost in breath of animals; and 3, how little of the mineral matter is carried off the land.

Table IV.—*Showing the Total Weight in lbs. of Crops raised in Four Years on an Acre of good land, and some of the most important of their constituents, (omitting others.)*

	Total Weight of Fresh Crops.	Water.	Total Dry Matter exclu. of Ash.	Organic Matter.		Inorganic Mat.		Total Ash.
				Carbon.	Nitrogen	Phosph. Acid.	Potash.	
Wheat 32 bushels	2,000	250	1,710	800	42	20	10	40
Straw 30 cwt. & chaff	3,750	450	3,100	1,500	10	5	16	200
Barley 48 bushels	2,500	300	2,140	1,000	40	20	10	60
Straw, &c. . .	3,350	500	2,650	1,300	8	6	6	200
					Ab't 100			
Roots—								
Bulb 20 tons .	45,000	41,300	3,400	1,700	75	26	116	300
Tops 8 tons .	18,000	15,500	2,300	1,000	90	10	18	200
Grass 6 tons . .	15,000	11,000	3,700	1,700	70	20	70	300
					Ab't 240			
Nearly . .	90,000	70,000	19,000	9,000	350	107	246	1,300

The next point to be examined is, what portion of the crops is removed from the farm, and what is returned to the soil in the usual course of good farming.

In the first place, the grain crops take off about one-fourth part of the carbon, about 80 lbs. of nitrogen, and about 50 lbs. of phosphoric acid, or 1 cwt. of phosphate of lime; what they take besides is practically insignificant.

Another part of the produce that goes to market is the live stock or dead meat. The carbon contained in a few score of meat is not worth calculating; the nitrogen is only about 1 lb. to the score sold off, and the phosphates about half the weight of the bones of the animals: say about 35 lbs. for the whole of the stock fed on one acre of land, in the course of 4 years. In the case of dairy farms or breeding farms, the quantity of phosphates yearly carried off in cheese and in bones of animals reared on the farm is greater than on arable farms; but a little bone-dust will supply the deficiency.

Those who have not attended to chemistry will feel some surprise when I state that, though the live stock do not carry much carbon to market on their frames, they have consumed — that is, fairly burnt away — in their lungs during their lives about half of all the carbon contained in the roots and grass which they have eaten. The mineral matters contained in their food pass through into their dung practically undiminished, with the exception of the phosphate laid up in their bones. To the carbon sent to the miller in the sack we must therefore add about a ton of carbon blown to the winds, and perhaps helping, as part of the air, to drive the sails of the windmill, or tumbling over the wheel in the water, which, after falling on the hills as rain, is on its way to the ocean, there to be converted into food of sea-weeds.

The account then stands thus in round numbers:

	Returned to the Farm.			Removed from the Farm.	
Phosphates	1 cwt.		Phosphates	1 cwt.	
Nitrogen	2¼ “		Nitrogen	1¾ “	
Carbon	over 2 tons.		Carbon	under 2 tons.	
The carbon represents fresh vegetable matter:			The carbon represents fresh vegetable matter:		
In straw	7,000 lbs.	Over 24 tons.	In grain	4,500 lbs.	Under 16 tons.
Fodder passed through animals as dung,	30,000 “		Fodder consumed in breath	30,000 “	
Leaves trodden in	18,000 “				
	55,000 “			34,500 “	

The practical result of this analysis of the four-course system is that about one-half the carbon of the crops regularly leaves the farm, together with about a cwt. of nitrogen and of phosphate respectively. This quantity of carbon represents no less an amount of vegetable matter in its fresh state than 15 or 16 tons, which, not having been returned in the form of manure, and not existing in the soil in an ordinary state of condition, must have been exclusively derived from the atmosphere. How the nitrogen and the phosphate are replaced we will inquire presently; but, as a comment on the mineral theory above referred to, it is a remarkable fact that, under the best system of English farming, not only is the greater part of the mineral constituents of plants left on the farm, but a considerable addition is made to them in the form of purchased food. It should also be observed that I have not taken into account the corn which is consumed by horses or given to stock on the farm.

HOW ARE THE ELEMENTS OF THE CROPS TO BE REPLACED?

One conclusion I think you will at once see follows from what has been said, viz: that however valuable farmyard dung may be, it is hopeless for the farmer to attempt to replace in the form of straw-manure all the vegetable matter which the usual course of farming removes from the land, seeing that by an inevitable law of nature several tons of vegetable matter must every year be consumed and turned into gas by the feeding of stock, unless you should think it profitable to plough in all your green crops instead of consuming them by live stock. We must therefore look further to ascertain the true reasons for applying manures and the principles on which they are to be selected.

WHY IS FARMYARD DUNG SO VALUABLE?

As regards farmyard dung its value probably consists in several points. 1. That it presents a great choice of salts of all sorts in every state of combination, and in every digestible form, so that the plant finds all its wants easily supplied: well-made dung is always rich in ammonia, phosphates, and potash, which, as we have seen, are the elements of prime necessity. 2. It acts mechanically on the soil by loosening clay and binding light soils. 3. Its slow fermentation no doubt raises the temperature of the soil. And lastly, as it ferments and decomposes, it probably supplies carbonic acid to the roots of the plants, and so assists the action of the atmosphere and the rain, both in directly supplying carbon, and in dissolving the alkalies and other minerals in the soil. The objection to dung as the sole supply of the farm is, that it is expensive to make, bulky to move, and always insufficient in quantity; and on these accounts the chemist and the farmer have both done their best to find some cheaper means of keeping up the fertility of the soil and the supply of the food of the people.

WHAT IS GUANO?

There is hardly any fact in the history of agriculture which so impresses my mind with the sense of an overruling Providence as the introduction of guano into this country at the time when opposite classes were engaged in a struggle on the question, how are the people to be fed and how is the tiller of the soil to live?

For consider what guano is. In the crowded cities of old countries like England we annually consume an enormous amount of corn and meat, of which nearly the whole of the nitrogen and phosphates pass off into the sewers, from which as yet the wit of man, not to mention the wit of Mechi, has utterly failed to recover them; down they flow into the rivers and thence to the ocean, there as it might seem to be hopelessly lost. But stay, consider how the ceaseless motion of the sea diffuses these elements all over the globe, how the great forests of seaweed, feeding on the carbonic acid in solution, bring up the stores from the depth, how the fish feed on what floats in the water, and how the seafowl again, subsisting partly on the seaweed and partly on the fish and the animalcules attaching to the weeds, deposit their droppings on rocks in a rainless region, where the manure being quickly dried never ferments, and so by a wonderful provision of the Great Creator, we are permitted to go down to the sea in ships and bring back the materials of our food which our rivers had washed away. I refer to this fact not merely because in guano we have a supply of ammonia in a cheaper form (even at present prices) than any other in which manufactures or commerce can at present bring it into the market, but because I think guano has been the great practical schoolmaster of the English farmer. Our illustrious countryman Sir H. Davy discovered and expounded in his admirable lectures the theory of ammonia as a source of food to plants; but his lectures bore little fruit till we had the great practical proof that a man could draw into a 10-acre field in a single cart the essential ingredients of fertility which he could not formerly obtain without a hundred journeys of his wagon.

It being now an admitted fact that light and portable manures are indispensable to economical farming, the labors of our chemists have been urged on, not only by their own thirst for knowledge but by the general recognition of their utility, to discover what elements each crop requires, and from what sources these elements can be most cheaply supplied.

English Chemistry of Farming.

Claiming as we certainly may for our illustrious countryman Davy the honor of leading the way in the application of chemistry to agriculture, we must admit that since his day great progress has been made in France, and that Germany may well be proud of Liebig, not only as a most profound chemist, but also as having done much to awaken attention to agricultural improvement, and to engage in the service of agriculture some of the most eminent men of science. But it has been reserved for a country gentleman by a systematic course of field experiments, to bring, for the first time, the facts of practical farming, as carried on in England, to the test of scientific accuracy. For half a century *The Art of Farming* and the *Science of Physiology* had made separate and unconnected progress, but they were frequently at variance. Mr. Lawes of Rothamsted, aided by Dr. Gilbert (a chemist trained, I believe, under Liebig, and certainly a most competent scientific assessor,) has succeeded in bringing principles discovered in the laboratory by the great French and German chemists into direct and close application to our eminently practical art; and it must never be forgotten how much England owes to another country gentleman, Mr. Pusey, whose accumulation of the practical knowledge of all England, in the Journal of the Royal Agricultural Society, edited by him for fifteen consecutive years, has furnished a constant check to hasty and premature conclusions suggested by scientific discoveries.

EXPERIMENTS OF MR. LAWES AND DR. GILBERT.

I will now endeavor to set before you very shortly some of the principles established by Mr. Lawes and published by him to the world in 1847, after several years spent in a course of experiments which stand unrivalled in the History of Agricultural Science, for the scale on which they were conducted, without sacrifice of rigidly strict accuracy.

It is, however, due to Mr. Lawes and Dr. Gilbert that I should state that they are in no way answerable for the accuracy of this account of their experiments made more than seven years ago—in fact, it was prepared without their knowledge, and chiefly from their earlier papers. Those papers have been the subject of most searching discussion, and I am not able to say that subsequent investigation may not have modified some of the first results of the Rothamsted inquiries. My chief object has been to sketch a bold outline, and to impress upon the minds of some of the rising generation the amount of labor necessary for gaining an accurate knowledge of even one or two points of agricultural science.

The two practical conclusions to which these experiments lead are these: 1. That in order to increase your crop of wheat you must give the plant an artificial supply of ammonia; and 2. That in order to grow turnips at all you must add a special supply of phosphate of lime. I mention these two practical results at once that you may bear them in mind while you hear an outline of the course of inquiry by which Mr. Lawes arrived at them.

The great progress made by chemistry since Davy's time rests for its basis of proof on the gradual accumulation of analyses of animal and vegetable produce by German and French chemists, and more recently by Way, Gilbert, Johnston, and others in England, among whom we must not forget our own Dr. Voelcker. But I have more than once hinted at the caution, that we must not hastily assume the percentage of any particular constituent found in a crop to be a safe guide to the kind of manure which must be applied in practical agriculture.

Peculiarity of Cultivated Plants.

The reason why some persons have drawn this inference too hastily is this, that they have not sufficiently borne in mind the distinction between the requirements of plants in a state of nature and those of plants cultivated for special purposes on ground limited in space, and under circumstances in which profit or loss depends both on making the most of the space and on not wasting time. With regard to all crops it must be remembered that the whole plant is not equally important to the farmer. In cereal and leguminous crops what we want is the seed, in turnips and mangold-wurzel the roots, in others only the leaf and stem: to these parts respectively we wish to give the greatest development consistent with the general health of the plant. The principles which explain how large forests thrive on mountains, or even how a few crops may be rapidly raised on virgin soils, are no safe guide to the regular course of cultivation which must be adopted in an old country like England. Liebig appears not to have sufficiently attended to this distinction; and finding that trees and plants derive, under certain circumstances, all their ammonia from the atmosphere, he was led to give his exclusive attention to the supply of mineral elements of manure, and to advise the farmer to dispense with all artificial supply of ammonia. We shall see how this fails in the case of corn crops.

Importance of Particular Organs of Plants.

Another principle appears very important in the growth of plants, viz. that some elements are required in certain stages of the plant in order to develop particular organs to an extent far beyond that which would be indicated by the analysis of the full-grown plant. It appears that the plump, full quality of the grain of wheat depends not upon its richness in gluten (the nitrogen or flesh-forming compound, and therefore the most nutritious to the working-man,) but on the abundance of starch, in which there is no nitrogen, and yet that the elaboration of this starch depends to a great extent on an abundant supply of ammonia; this ammonia seems to be required to foster the growth of the leaf and stem, and generally to promote vigor in the circulation of the plant; but the quantity of nitrogen eventually found in the crop would not correspond with that required in the earlier stages of the plant's existence. In turnips, on the other hand, it seems equally important to the development of the young roots, and to the early childhood, so to speak, of the turnip, that it should be supplied with phosphate of lime in a state of delicate solution, like the pap supplied to the infant; but the percentage of phosphate of lime in a crop of turnips is, as we have seen, not so large as that of the same mineral in a crop of wheat or barley. I remember very well the strong impression of disappointment under which, when superphosphate of lime was first talked about, I searched in books for evidence of the opinion that turnips required a liberal supply of phosphate of lime, on account of the proportion of that substance in the plant as shown by analysis. In fact, analysis taken by itself does not lead to this conclusion, but requires to be combined with other considerations derived from practical experience.

EFFECT OF CLIMATE.

There is a third principle which governs all chemical inquiry into the growth of plants, and that is the effect of climate; and by climate is to be understood the variations of the amount of rain, and of the time during which rain falls on any spot; also the variations of heat and cold, both as to the general average, and as to the highest point of heat in the summer, and the lowest point of cold in the winter. This is a point of special importance to the West of England farmer, because our climate has certain special characteristics of its own; and, fortunately for us, one of the very best and most zealous inquirers into this subject is a West of England man, Mr. Whitley of Truro. It seems that, in certain seasons, the effect of climate is greater than that of manure; so that, according to the old proverb, seasons beat judgment. A well-manured piece of land may sometimes fare worse than another which has been only cleaned and left to nature. The importance of rain or of sun at certain particular seasons is well known to the practical farmer. The absence of rain during the time when plants are forming their leaves, or cool weather while the seed is being filled, will modify all the farmer's calculations, and must, in like manner, be taken into account by the agricultural chemist. Mr. Lawes tested the power of the soil to produce crops without manure, as a means of judging of the effect of atmospheric influences alone; and he found that the lowest weight of the bushel, and the greatest amount of straw, corresponded with the season in which there were the lowest summer heat and the greatest number of rainy days; the least amount of straw corresponded with the driest season, and the finest quality of grain with the hottest summer. He also found that the effect of season on a great number of plots treated with various kinds of manure corresponded with that upon the unmanured spots. All these facts he has minutely registered and compared, and they lead to the conclusion that no variation in the quality of manures will enable the farmer to overcome the effect of climate, but that something may be done by a careful study of the laws of atmospheric action to adapt the management of the land to the conditions under which it is placed, and so to take advantage of what is favorable, and to avoid what is the reverse.

We are indebted, then, to Mr. Lawes for giving scientific accuracy to the common observation and experience of the farmer on these three points. 1. The difference between the conditions required by a cultivated vegetable on a farm, and those of a wild plant. 2. The great importance of examining the functions of separate organs of the plant, and adapting the treatment accordingly. 3. The extent to which all calculations as to the effect of manures must be modified by considerations of climate.

EXPERIMENTS ON WHEAT AND TURNIPS.

Bearing these three points in mind, let us hear what Mr. Lawes has to tell us about wheat and turnips, and what is the nature of the evidence on which his opinions rest.

His laboratory has two departments, one in-doors and one out of doors. The first is a large barn, in which his analyses take place, of the scale of which perhaps I can best give you an idea when I say that the platinum capsules—pieces of apparatus which in an ordinary laboratory are about the size of very minute saucers—are, in Mr. Lawes's case, about the size of tea-trays, involving a hot-water drying apparatus for evaporations, and other appliances on a proportionate scale. The second department of his laboratory consists of two or three 14-acre fields, divided into half-acre pieces. The whole of the crops grown on these plots for several years were separately weighed, and samples sorted and laid up for analyses. Besides the experiments on these crops, another and a very extensive series of investigations into the feeding of sheep and pigs has been carried on for several years, involving the weekly weighing for 6 months not only of 20 or 30 animals, but of their food and their excrements, and the subsequent analysis of the same.

Mr. Lawes's Experiments on Wheat.—One great value of Mr. Lawes's experiments is that they were tried, not in artificial garden soil, but in an ordinary field, at the end of a course of practical cropping, and therefore in that state which a farmer considers practically worked out as far as manure is concerned. One portion of this land has been preserved, year after year, in its natural state, as a permanent standard for comparison with each kind of manure. Side by side with this unmanured spot he has tilled wheat and turnips on about twenty-four strips of land with as many different combinations of mineral manures. These strips were crossed again with the manures containing ammonia and carbon.

One remarkable fact is elicited by the unmanured spot, that a certain amount of wheat may be grown, year after year, without the addition of any manure whatever, and that this amount will not vary greatly in the same soil. In the case of Mr. Lawes's land the amount was about 16 bushels, and 10 cwt. of straw.

1 The first point established is that *mere mineral manures*, such as are found in the ashes of plants, *will not increase the yield of wheat without the addition of ammonia.* Various combinations of potash, soda, magnesia, lime, as phosphates and silicates, were tried, and the greatest increase obtained was 2 bushels of wheat and 84 lbs. of straw; and to put the matter to the strongest test, the ashes of 14 tons of dung were tried without any increase of the natural produce.

2. *The addition of ammonia to some of the mineral manures produced an immediate rise in the produce*, varying from 4½ to 9 bushels of wheat, and from 2 to 5 cwt of straw. The same effect was even more striking when the addition of ammonia was made, in the second year, to the spots where it had not been applied in the first year, but on which minerals had been applied without any good

result. It now produced a great increase of crop, showing that the mineral manures had been lying dormant for want of the ammonia. Liebig's patent manure was treated in like manner; when applied alone it yielded insignificant results; when applied with the addition of a salt of ammonia, an increase of 14 bushels of wheat and 10 cwt. of straw ensued.

These experiments, extending as they did over 50 spots of land during several successive seasons, and also brought to the test of the scales, are generally considered to have given decisive proof of the principle that the natural produce of wheat cannot be increased without an extraneous supply of nitrogen or ammonia. And Mr. Lawes states as his opinion that every bushel of wheat, containing in itself about 1 lb. of nitrogen, requires 5 lbs. of ammonia for its production, instead of 1¼ lb., which would contain 1 lb. of nitrogen. If this be so, the wheat-plant is a great waster of ammonia, and some good chemical reasons have been assigned by Professor Way for this consumption of ammonia, which are very interesting in a scientific point of view. At any rate, the principle laid down by Mr. Lawes is in harmony with the experience of the farmer as to the exhausting character of the wheat-crop if too frequently repeated without rich manure, and as to the power of bare fallows on clay to ensure a crop of wheat up to a certain average. With regard to the means by which ammonia is to be replaced, it is needless to suggest that every step should be taken to assist the soil in collecting the lost ammonia from the atmosphere, and therefore to that extent to save the farmer the expense of purchasing so expensive an article. It was for this reason that the naked fallow was invented; that lime is applied to clay; that underground-draining and subsoil-ploughing are found so beneficial on heavy land. But in order to explain how the ammonia is restored in the most practical manner by a rotation of crops we must pass on to Mr. Lawes' experiments on turnips.

Mr. Lawes' Experiments on Turnips.—The turnips is in all its habits opposite to the wheat-plant, and its cultivation in modern farming is in the highest degree artificial. It is sown out of season on purpose that its seed may not ripen, and that an unnatural development may be given to one organ—the bulb. The consequence is, that peculiar conditions in the soil and in the atmosphere, and a peculiar supply of manure are required, in order to secure not merely a good crop, but any crop at all.

In Mr. Lawes' experimental field the unmanured plot produced in the first year but 4 tons, which, in the third year, dropped to 13 cwt., and the roots had dwindled down to the size of radishes. in this respect, then, turnips differ from wheat; and although they derive a much larger portion of their substance from the atmosphere, they are more absolutely dependent on manure of some sort. The question to be ascertained is, What is the particular quality or substance in manure which the practical farmer has to supply? As turnips contain so large a percentage of nitrogen, which, as we have seen, is obtained in the form of ammonia, it is natural to suppose that a liberal dressing of ammonia is to be supplied by artificial means; and this idea is at first favored by the experience of those who are in the habit of applying all the dung they can make to their root-crops with success. And some farmers I know are of opinion that the ammonia of guano is valuable as a support to the turnip in the later stages of its growth. Mr. Lawes' experiments point to a somewhat different conclusion; in fact, they prove that an excess of ammonia is very injurious to the turnip, because it promotes an excessive development of leaf with a decreased proportion of weight in the bulb. This is shown by the mean results of many experiments with compounded manures; but the following instance will put the principle in a striking light. Twelve tons of farmyard dung produced 17 tons per acre of bulb and 7 tons of leaf. The same quantity of dung, with the addition of a salt of ammonia, produced less than 15 tons of bulb, but 10 tons of leaf, showing an increase of 3 tons of leaf at the cost of 2 tons of bulb. Ammonia, then, is not the specific for turnips.

There are some facts which show that the proportion of nitrogen in a crop of turnips may be increased by a supply of ammoniacal manure, but I think they do not practically effect the position, because the pecentage of nitrogen is by no means the test of the profitableness of the crop.

Space will not permit me to go through Mr. Lawes' experiments in any detail, but the result may be stated thus:—That, however favorable the season may be to the growth of turnips, a crop cannot be obtained without a supply of certain minerals. That the mineral chiefly required is phosphate of lime, and that that must be supplied in a finely divided or dissolved state. That this mineral supply will not avail to carry the crop on to full maturity without a supply of carbonaceous matter, such as that of straw-dung or rape-cake, unless the land is already in good condition, that is, rich in vegetable matter in a state of decomposition.

Mr. Lawes has also shown by detailed experiments that in considering the effect of manures, especially in the case of root-crops, we are not to consider merely the constituent parts of the crop, but the healthy action of the organs of the plant. And it appears that the importance of superphosphate of lime is connected with this principle. This mineral seems essential to the healthy underground development of the net-work of roots: without a supply, therefore, of this material the plant never gets a start. A certain amount of ammonical manure conduces to the expansion of the leaf, which seems to be the apparatus provided by nature for collecting both carbon and ammonia from the atmosphere: I say provided by nature because a further and more artificial process has to be performed late in the season, namely, the excessive and perternatural development of the bulb. This appears to be especially promoted by the early development of the fibres of the root caused by superphosphate, and now comes into play the store of carbon laid up in the soil in the form of farmyard-dung or other organic manures.

This view of the subject is, no doubt, to a certain extent hypothetical and beyond the reach of positive proof; but the facts appear plain: that the entire omission of phosphates is fatal to the development of the plant; that the excess of organic manures, such as guano, &c., is dangerous; and that a full development of bulb is never attained where there is not an accumulation of carbon in the soil or where it is not added as manure.

Practical Conclusions.

One or two practical conclusions from the facts just stated may be added.

That the tilth, to which all farmers attach so much importance, is essential to the early development of the fibres of the root. That the mineral manures (superphosphate) should be placed in close contact with the seed. That organic manures should be sown broadcast and widely mixed with the soil, so that the extensive apparatus of fibrous roots may find food everywhere while they are sustaining the bulb after the leaf has passed its most active stage. It would also seem that an opinion expressed in one of the excellent papers on root-crops in our volume of last year, that roots may be as well grown on the tops of our hills without dung as with it, requires some modification, namely, that on thoroughly poor land this should not be attempted at first, unless indeed a long accumulation of weeds may be supposed to supply the vegetable matter required; when the land has been effectually cleaned, and a good crop fed off on the ground, the case becomes altered. Where the dung-heap is far off at the bottom of the hill, Mr. Lawes's experiments show that a few cwt. of rape-cake will play the part of several tons of stable-dung with good effect.

THE PRINCIPLES WHICH REGULATE THE BREEDING OF FARM STOCK.

BY HENRY TANNER, M. R. A. C.,
Professor of Agriculture and Rural Economy, Queen's College, Birmingham.

[*A Prize Essay, from the Journal of the Royal Agricultural Society of England, Vol.* 22, 1861.]

The careful observer of nature has ample proof that her works are all carried out in accordance with fixed rules, and no one has better opportunities for securing this evidence than the agriculturist. A modification of circumstances may cause a variation in the results; still there is, throughout his experience, a thread of evidence which proves the existence of established laws. The importance of farm-stock is daily becoming more fully recognized, and truths applicable to the whole class can be traced out and determined most satisfactorily by attention to individual specimens. The variation in the feeding capabilities of different animals is a fact which needs not to be enlarged upon, for every farmer knows that whilst some animals are such good feeders that they pay by an increase of weight for all the food which they consume, others, for the purpose of fattening, would be dear as a gift. Assuming, then, that such a difference exists, I propose to show and explain, as briefly as possible, the rules which govern the results required and the system to be followed in putting them in practice.

It materially lessens our difficulty to know that in the breeding of all varieties of farm-stock—cattle, sheep, pigs, &c.—the results seem uniformly to follow the same fixed but simple laws. It is an old and approved maxim that "like produces like;" but this rule, though generally true, may be misapplied, when the error will be demonstrated by the contradictory evidence of practice and experience. If an animal is capable of transmitting any character to its offspring, it must possess that which it conveys, although at times qualities may predominate in the offspring which were almost latent in the parent. If, therefore, any quality or character rendered hereditary, it must correspond with that inherent in the parent from which it descended. If, however, I breed from a female possessing certain qualities by a male distinguished by an opposite character, it is clear that the offspring cannot perpetuate *both* of these characteristics, and the result appears antagonistic to the maxim that "like produces like." This brings us at once to the consideration of one of the most important principles connected with breeding, namely, that although "like produces like" (for it can produce nothing else), still when the parents possess opposing qualities the preponderance is exercised by that one which possesses the hereditary tendency in the greatest strength. If, for instance, a cow having any special peculiarity of form is put to a bull having the opposite character, the offspring will assume the character of that parent which possessed the greatest hereditary powers in this respect, or, in other words, the greatest purity and unity of influence. If these hereditary powers are under our control, it is important to consider by what means they may be increased or diminished.

In breeding from a ram and ewe possessing a similarity of type, the produce of such an union will of necessity also possess the like character, but in a higher degree. Thus the result of breeding stock of similar character is that these peculiarities are not only perpetuated but intensified in the offspring. Provided that the parents possess similarity of type in any given particular, every successive generation thus produced acquires an increase of hereditary force, by which we mean the power of imprinting its own stamp upon its progeny. But in like manner as this power accumulates when there is a similarity of character, so also does it diminish when the parents have opposite or antagonistic characters. Suppose that a well-bred ram, by careful breeding through several successive generations, has acquired strong and valuable hereditary powers (which, for illustration sake, we will represent in figures), say equal to 100. If this animal be put to a ewe of a totally different character, say having hereditary power equal to 60, the result would be that the offspring would still possess the same character as the ram because of his superior hereditary power; but the hereditary capability of the offspring would be reduced to say 100—60=40. Supposing the offspring to be a ram, at a subsequent period both the sire and offspring may appear equally perfect in form and general character; but the power of hereditary transmission being so much greater in the sire than this offspring (in proportion of 100 to 40), the former would be far more valuable as a breeding animal, although the difference in the capabilities of the two would be entirely hidden or latent. If you breed from animals possessing a similarity of type, the offspring will possess the same character, but with a greater power for the hereditary transmission of this character. On the other hand, animals having opposite characters mutually weaken each other's influence, and the offspring only possess the power of hereditary transmission in a reduced degree.

This power of perpetuating character is not confined to any one quality, but it extends to every peculiarity of the animal, whether it be similarity of feature, configuration of the body, general habit of growth, disposition for fattening, the formation of milk, healthy constitution, predisposition to disease, temperament,—all are alike hereditary and are modified in their transmission by the mutual influence of the parents. It would appear as if every individual point of character were thus controlled and balanced according to the respective tendencies of the parents, and that the resultant character represented a series of balances, sometimes in favor of the male, at other times in favor of the female. The dam might succeed in communicating the general form to the body, but be unable to overcome the stronger power of the male over some certain portion of the body. The dam might be naturally deficient, for instance, in her hind-quarters and good in other parts, and under the influence of a sire having a powerful tendency to produce a good hind-quarter, she may be compelled to yield to his superior influence. In certain points of character, where they corresponded, the influence would be increased. In some particulars the dam might predominate, and in others respects the sire might be most influential. Thus the hereditary powers of carefully-bred stock will represent the maximum of good influences and a minimum of those which are undesirable.

In our wild animals we have natural laws operating whereby they are preserved from degeneracy. Thus their powers of vitality are preserved and constitutional disease reduced to its lowest point. Immediately the male has passed the prime of life and his natural vigor begins to diminish, he ceases to hold his position against younger males of more strength. Thus in the sanguinary conflicts amongst the male animals of wild species, in which the supremacy is contested, we see one means established by Nature for securing the perpetuation of the species to the strongest and most vigorous males. In like manner, those of unripe age, as well as those which are the subjects of disease, are held in check by those which are vigorous and healthy, and the consequence is that a strong constitution is secured to their offspring. By domestication we interfere with the action of these natural laws. We seek to establish and perpetuate certain peculiarities of the animal system which are unnatural, but which are, at the same time, very desirable for our comfort and prosperity. There are three special objects which the general breeder seeks to attain with a view to direct profit, each of which requires a special mode of procedure which cannot be departed from without loss. These qualifications are—

A liberal production of good milk;
An economical formation of meat;
And the preservation of purity of blood.

I shall endeavor to prove that we have these important points of character far more under our control than is generally imagined, and that from want of due consideration we often frustrate and impede our designs.

PRODUCTION OF MILK.

The milking character of our various kinds of stock takes a wide range even amongst females of the same class. Apart from the influence of food, we may remark that the quantity of milk secreted depends upon the supply of blood which the mammary glands receive as well as upon their activity, whilst its quality is mainly dependent upon the internal organism of the animal. We find, as a rule, that those domesticated animals which exist under circumstances most nearly approaching to a state of nature possess the greatest tendency to produce milk. The formation of milk is a provision of nature to supply food for the young offspring; it precedes the birth of the young animal, and is generally most abundant in those animals which breed most freely. If, however, by domestication we produce an animal possessing peculiar qualities which differ from the natural character of the dam in its wild condition, then the powers of reproduction are decreased and the energy of the system is also reduced for the formation of its accompanying product, milk. Although these two points of character, viz.: a disposition to breed and an aptitude for the secretion of milk—usually increase and diminish similarly, yet there are good reasons for believing that, like other functions of the animal organism, we may materially increase the formation of milk even when the breeding powers are naturally weak. In producing animals which differ materially from the type of the animal in its wild condition, we find that natural barriers present limits beyond which we cannot pass, and consequently by degrees we approximate to instances of barrenness in the offspring. To meet this difficulty we have adopted measures for giving increased vigor to the system, or, as we commonly term it, to strengthen the constitution of the animal; but what are the measures adopted for this purpose other than allowing the natural habits of the animal to exert their legitimate influence? in fact, retracing some of the steps previously taken in excess.

The formation of milk we have more under control than the powers of reproduction; for when the mammary glands have been brought into a state of activity by the birth of a calf or other young animal, then the continuance of the flow will be influenced by the hereditary character of the parents as well as by judicious management. This hereditary influence must not be viewed as confined to the female, for I have not the slightest doubt on my mind that the constitution of the sire tells powerfully upon the offspring in this respect. A bull, the produce of a good milking family, has a tendency to convey this disposition to his offspring, and greatly to strengthen similar tendencies which may be hereditary on the side of the dam. On the other hand, the use of a bull descended from a bad milking-family leads to the rearing of a class of stock possessing less value for the production of milk. In too many cases bulls have been preserved for use in ordinary dairies simply because of their symmetry or tendency to fatten, without due consideration of the milking character of their ancestry. With regard to sheep also, I remember a very striking instance of the loss of milk in a flock (previously celebrated for their supply of milk) being traced entirely to the use of a very well-formed ram, bred from a ewe singularly deficient in milk. In this case all his stock to the second and third generations possessed or imparted this undesirable character. A large proportion of the losses in our flocks and much of the additional labor and expenses occasioned by ewes being short of milk may be traced to this cause. This deficiency of milk amongst our ewes is becoming a serious evil throughout the country: one, no doubt, which has accompanied the introduction of high-bred sheep—rather, let us hope, by oversight than as a necessary consequence. Amongst all classes of stock—cows, ewes, and sows—we find a great disposition for the accumulation of fat usually attended by a deficiency in the flow of milk; but there does not appear to be any reason why both of these points of character should not be combined in the same individual, as we shall subsequently consider more fully.

The quality of the milk bears an important relationship to the quantity which an animal produces. The richness of milk depends upon the quantity of fatty matter present, which is more familiarly known as cream and butter. The general structure of the animal body, together with its mode of living, also appear to control the value of the product. For the production of a rich milk two qualifications are necessary in the animal.

The first step is to separate and prepare the fatty and nutritious elements of food, so as to introduce it into circulation with as little loss as possible.

The second step is to separate a large proportion of these elements in the form of rich milk.

Any circumstance which causes a waste of the fatty and nutritive ingredients in the food necessarily causes the milk to be of inferior value. It is exactly the same with the formation and preservation of the fatty matter of the blood, whether its subsequent appropriation be as the fat of milk or the fat of the body; for that animal which can most economically convert the fat-producing matter of food into the fatty matter found in the blood has most successfully accomplished the first step. In the fattening of a bullock, as well as in the feeding of a milch cow, the fatty matter of the food has to be taken up into the blood, and its depends upon the organism of the animal whether it shall be deposited in form of fat or excreted as the cream of milk. It is, however, evident that an economical preparation of the materials of the food is equally important for the formation of the fatty matter of the blood, whatever may be the form into which the animal system may convert it; and for this reason those animals which are best adapted for fattening are also best prepared to fulfil the first condition essential for the production of rich milk.

We have now to consider the influence of the animal system upon the rich fatty matter circulating in its blood. The formation of milk is primarily dependent upon the activity of the mammary glands, which are naturally excited to action a short time prior to the birth of the offspring. The energy of these glands is naturally superior to the tendency which the animal possesses for the formation of fat; so much so, indeed, that when the food is deficient in oily matter fat which has been already formed is sometimes taken up again into the circulation and separated by the mammary glands in the milk. Thus we find that when these glands are acting in a healthy and energetic manner, the fatty matter of the blood is freely separated by their agency, and we have a rich milk produced. In very many instances these glands have assumed an unnatural and torpid condition, have become less susceptible of the energy usually imparted by the birth of offspring, and have been influenced by it for a shorter period of time. In such cases, although the food may have been well prepared and the blood may travel through the vessels of the glands richly laden with the elements of milk, yet, from their torpidity, they may fail to appropriate it as milk, and the blood may pass on to yield its treasure to other parts of the body. Our great endeavor should therefore be to encourage a more active condition of these glands. These organs, in common with other parts of the system, are subject to hereditary influence, and much may be done in this direction to stimulate them to the performance of their natural functions, whilst a neglect of this agency will increase and perpetuate an evil which considerably reduces the value of much of our breeding-stock. Not only may we hope that by judicious management these organs may again be raised to their natural standard of efficiency, but, like other parts of the animal system, become even more highly developed under the fostering care of man. Instances are by no means rare in which we observe in happy combination an aptitude for the formation of fat with sufficient energy of the mammary glands to produce a liberal supply of milk. Generally, in the case of cows, those that produce butter freely are subsequently found profitable for feeding for the butcher. With ewes thus distinguished the lambs thrive without extraneous supplies of milk, and they are equally disposed for laying on fat when no longer intended for breeding. This combination is equally observable in sows of a like description, which produce large, healthy, thriving farrows, and make a good return for the food given them.

FORMATION OF MEAT.

When the object to be attained is the production of meat, many points require consideration. Much will depend upon the management and attention of the feeder, and in this respect it has been fully proved that it is essential for the economical production of meat that the animal should be kept in a thriving condition from its birth. Our attention, however, is here specially due to those consequences which result from the natural character of the animal. One of these is the capability of the dam to nourish her offspring, or, in other words, her power of producing a free supply of good milk, to which we have before adverted. Other points of character being equal, this capacity for the formation of milk will very powerfully influence the value of the dam for the purpose of rearing an animal especially intended as an economical producer of meat. Moreover, besides this supply of good milk after birth, we must not overlook the support given by the dam to the "fœtus in utero"—one that has many analogies and affinities to the yield of milk afforded to the young animal after its birth. A good milker will produce her offspring fatter, finer, and in better condition than a bad milker; whilst a puny calf tells us of a dam which has an overpowering disposition for the formation of fat. The importance of balancing these competitive tendencies so as to secure an adequate supply of milk is of primary importance for the economical breeding of animals intended to be producers of meat; whilst as this superior milking character is not generally possessed by high-bred stock, they would, by this rule, be set aside (in the majority of instances) as not being the best adapted for this object, and practice confirms this view. This capability of the dam to nourish and support the offspring should, of course, be accompanied by a well-formed and roomy body capable of affording the young suitable accommodation for their development and growth.

But the chief point we have here to regard is that the progeny should have, by nature and character, a special capacity for the economical production of meat, or, in fact, be good machines for changing vegetable productions of various kinds into animal matter. Here again the evidence of practice is very decided, as showing that our well-bred stock will produce more meat from a given quantity of food than those of inferior quality. I have shown in other communications* in what manner the system of management adopted and the peculiar conformation of the body which is possessed by all well-bred stock—whether cattle, sheep, or pigs—promotes the economical production of meat. It is enough for our present purpose to record the fact that the squareness of frame, the small proportion of offal, the docile disposition, and the smallness of the lungs possessed by all animals of this description are well calculated to favor the production of the largest quantity of meat of the best quality from any given quantity of food with the least loss in its conversion. These, therefore, are most important points of character to be imparted to any animal which is simply to be used as a means for producing a certain amount of animal food. For these reasons, the dam should be well-formed, healthy, and a good milker, and the young animal should receive from its parents that conformation of body and constitution which render our high-bred stock such economical producers of meat. These are, however, in some degree antagonistic requirements; for, as we have before seen, those animals which possess a strong tendency for the formation of fat are not generally remarkable for being good milkers: yet such a combination is desirable if it can be attained, and the two objects are not irreconcilable. Practically, there will be no difficulty in selecting a well-formed healthy female, capable of nourishing her progeny in a satisfactory manner, and we must endeavor to communicate to the offspring those necessary qualifications which are deficient in the female by means of the sire. To accomplish this result, a male should be selected which has been very carefully bred, and whose ancestry during several preceding generations has possessed those qualifications which distinguish well-bred stock as economical producers of meat. Such a male, in consequence of such parentage, will have concentrated within him powers of transmitting this character to his stock proportioned to the length and purity of his pedigree. If this male were put to a female possessing hereditary powers of less powerful character, it is manifest that the male will have the greatest influence upon the offspring and impart to it a similar disposition for rapid feeding to that which it possessed. In this manner we can transmit from the male the predisposition to form meat economically, whilst in the female we have secured the means for bringing this character to the fullest and most vigorous development. The more fully these characters are possessed by the parents respectively, the more perfect will be the result. It is desirable that the female should not only be competent to produce and freely nourish her offspring, but also that she should not possess strong hereditary powers to oppose and counteract the influence of the male. The male should have the guarantee of a well-guarded pedigree for that unstained unity of character which by its concentrated energy is so influential upon the offspring.

---

* 'Journal of Highland Agricultural Society,' No. LXIX., page 321. 'Journal of Bath and West of England Agricultural Society,' vol. vii. page 57.

Some may, however, anticipate that a similar result would be attained by breeding from a very well-bred female by means of an inferior male. This, however, would not be the case, and a moment's consideration will show the cause of this variation. In the former case we have a female capable of fully developing and nourishing her young, more certain as a breeder, more hardy in constitution, and consequently more free from the seeds of disease than in the latter. On economical grounds also the contrast is great, for by the one plan you require but one valuable and expensive male animal, whilst under the other system each of the females has to possess this pedigree value. We have therefore every inducement to breed from females well adapted to produce the finest offspring, and to use male animals capable of imparting those qualities which all will admit are desirable for the production of meat. This is no new principle, for it was advocated more than twenty years ago by the late Lord Spencer, who in the first volume of the Royal Agricultural Society's Journal has recorded his conviction that the worse bred the cow may be the more fully will the calf resemble the bull. An instance illustrating this principle came under my notice while I was inspecting one of the late Duke of Bedford's well-managed farms. I was very much struck with the superior quality of about 100 or 120 store pigs, as much alike as possible, and all admirable in form and condition. I expressed a wish to purchase some for breeding, but I was told, in a reply characterized alike by candor and sound judgment, "valuable as they are for feeding, they are worthless for breeding." Great as was my first surprise, no explanation was needed when I saw the parents. The boar was exceedingly well made, and very fine in quality, with a most careful pedigree, whilst the sows were large, coarse, and ugly, but excellent breeders and good milkers, thus producing large farrows and pushing them rapidly on towards maturity.

An interesting communication appears in the Journal of this Society (Vol. xiv., p. 214), from M. Malingre-Nouel, bearing upon this subject. He introduced into France some of our choicest

English rams for the improvement of the native breeds of sheep, but the lambs obtained were in no way improved by their use. By long-continued breeding in and in the French ewes had hereditary tendencies far more powerful than those of the English rams, which rendered the influence of the latter quite inoperative. As soon, however, as some ewes were obtained by crossing different native breeds, the hereditary power became reduced to a very low degree, and the lambs subsequently produced by the English rams partook so closely of the character of the sires that they were considered by good English judges to have been pure-bred sheep from England.

For the economical production of beef the best stock will be obtained from good useful dairy cows by the use of bulls of thoroughly good pedigree. Indeed, I may observe that a bull can scarcely be too well bred or too good for such a purpose. provided that the natural vigor of the system be not sacrificed. The quality and influence of a bull determines the value of a large number of bullocks, and it becomes a matter of considerable importance to the breeder thus to impart to these a superior feeding character. When this influence is fully appreciated we shall not find bulls valued as so much beef, but rather as the communicators of certain feeding qualities which will render their numerous offspring either profitable or unprofitable to the grazier. In the case of sheep, a good supply of milk materially affects the value of the lambs; and too much care cannot be taken to preserve and encourage this excellent disposition. Combined with this the ewes should also possess hardy constitutions, and thus be capable of rearing healthy and thriving lambs. The ram should regulate the increase of quality, which must be discreetly governed by the local peculiarities of climate. The parentage of the ram should be investigated with equal if not greater care than his symmetry and general quality.

There is no variation from these rules even in the breeding of pigs. Here let the boar be distinguished by good quality and careful breeding, and the sow able to rear a numerous progeny to a high degree of perfection. Thus will a class of stock be produced eminently adapted for the economical production of meat.

PURITY OF BREED.

The production of animals for maintaining and perpetuating the pure breeds is a course of practice distinct from either of the preceding systems which we have noticed. In these the production of milk and meat respectively modified and regulated our proceedings, but for the present purpose we have to produce fixity of type, and to this end we must select animals possessing the same characteristics and the same affinities, that in each succeeding generation the same stamp may be more deeply and indelibly impressed upon the offspring. When there is any bad point of character to be overcome it is only to be accomplished by persevering in the use of a parent having, if possible, an opposite tendency, or at least as little as may be of that which is objectionable, by which means the evil, if not subdued in the first generation, will be gradually corrected by judgment and perseverance. The subsequent course of procedure will aim at rendering the character thus acquired as permanent as possible. Every generation will have the special character of the breed more and more powerfully concentrated, and consequently will be more competent to render these qualities hereditary. We have before seen that the influence of the parent upon the offspring is dependent upon the relative powers possessed by each individual. In the case of pure-bred animals there should be no opposing influence to weaken the hereditary tendencies of the offspring, but on the other hand a concurrent and sympathetic nature, so that the hereditary character may be confirmed and strengthened. Anything like a cross should be most jealously guarded against as introducing a conflict of influences, which impairs the character of the race.

It may, however, be said that if we do not get fresh blood we lose size in our stock. This sacrifice is greater in appearance than in reality, for presuming the opinion to be correct that the food consumed by animals of equal quality bears a regular proportion to their live weight, and there is good reason to believe that such is the case, then it is clear that the loss of size does not render the consumption of food less economical. This diminished size does not appear in any way to prejudice the stock produced when such sires are used with females of inferior quality having a good supply of milk. If we could breed in the same line and yet not lose size, it would be decidedly advantageous. This is a difficulty which the producer of pure breeding stock has to combat to the best of his judgment and discretion; but on no condition should size be gained by any stain in the pedigree. It were better to allow the diminished size to continue, for to maintain it at the cost of pure descent would be to sacrifice the main object in view. To meet any drawbacks attendant upon this maintenance of purity of breed, this stock should bear such a value, and bring such remunerative prices to the breeder, as to indemnify him against risk and losses, and open a fair prospect of profit. The decrease of size may, like every other point of character, be influenced by discretion in the management. An instance occurs to my mind of a celebrated breeder of sheep who was noted for maintaining size with great purity of descent. He made an invarible rule of purchasing his rams from a most carefully bred flock, and for twenty-two or twenty-three years—in fact, up to the time when he gave up business—he never introduced any other blood, but he was exceedingly particular in selecting the largest rams, being satisfied that whether large or small all possessed an equally pure pedigree. His extended experience thoroughly convinced him that his system was correct.

It has been judiciously remarked that it is much easier to bring any breed to the highest state of perfection than afterwards to maintain it in that position. The difficulties are undoubtedly great, but observation shows that they are not insurmountable. The relative advantages of breeding in and in and breeding in the line have scarcely been determined, but it is a subject worthy of consideration. Mr. Pawlett, a ram breeder of high repute, and the author of an Essay on Sheep, says:

"From a long experience and close attention to the subject for more than twenty years, my mind seems more disposed to favor breeding in and in, rather than changing from one flock to another. I do not recommend that animals closely allied should be put together generally, yet I have known a very good sheep, for instance, produced by putting the son of a ram called A to a daughter of A in cases where their points would suit each other, and I should never hesitate to do so."

Mr. Robert Smith, whose reputation as a ram breeder is equal to that of Mr. Pawlett, and who is the author of the Prize Essay on Sheep, takes a very different view of this question, and says:

"With crossing and breeding in and in I have been lamentably disappointed, there being no dependence on the first, and no size to be procured in the latter. Even in 'breeding in the line' much depends upon the union or knowledge of matching the male and female, particularly if selected from different families even of the same race, which have been for some time raised in other localities, and consequently influenced by climate, soil, situation, and treatment. When using rams of the same flock they should by no means be used nearer than a *third* remove in the same line of blood. I have, by repeated experiments, experienced by the nearer affinities of blood the most decided disappointment, but have raised some first-rate animals by putting together the third removes, when attention had been previously paid to the sort required."

In the former case the ram A stands in the relationship of *sire* to the two sheep to be bred together; in the latter case he stands as *grandsire* to both. In this way, by *diverging* from a favorite sheep, we again converge, and probably produce one or more sheep of the utmost value to that flock, as presenting some distance in relationship without any sacrifice of family merit.

With all the advantages derivable from breeding stock with good pedigree and great fixity of character, we find that not only are good qualities thus concentrated and rendered hereditary, but also others of less desirable character which may have been possessed by the parents. Thus we have in many cases a delicacy of constitution and a want of energy in the system, which is too commonly looked upon as a necessary result of high breeding, but I am inclined to believe that these results are much more referable to the system of management pursued. The delicacy imparted to stock by too much protection through the winter months in warm sheds and buildings, whereby they get glossy coats, ill prepared to resist atmospheric influences when they are turned out to grass in the spring, render such stock peculiarly delicate. This delicacy, when continued for several successive generations, becomes constitutional and hereditary. A moderate exposure to the cold of winter and plenty of exercise will enable cattle of the purest breed to keep a good rough coat, and although they may need more food, still this is a sacrifice perfectly insignificant in comparison to the advantages gained by strengthening and invigorating the system, instead of fostering a relaxed and enervated condition of body. Well-bred cattle reared in this hardy manner possess far more vigorous systems, and it should be remembered that whilst we concentrate in our stock valuable powers of hereditary transmission, these only become available in proportion as we preserve in them that vigor of health which will enable them to communicate these influences. The capability of stock for breeding is much reduced by the enfeebled condition of the body induced by rendering them delicate. This unfavorable influence is seriously increased by the general course of management now adopted, and the evil accumulates in a greater degree with every successive generation. An excessive quantity of fat in either of the parents is also unfavorable to the exercise of the breeding powers. These, however, are matters of detail which should rather be noticed under the general management of stock, but I have made reference to them because it is essential that breeding animals should not only possess certain points of character which are desirable for transmission to their offspring, but that they should also be in that vigorous state of health which will enable them to produce healthy descendants. It is no uncommon circumstance for well-bred stock to be drafted from the herd as incapable of breeding, which, when put to males of inferior breed, are found to be prolific. Much of this, doubtless, arises from a want of vigor of body induced by a debilitating course of treatment which would have been prevented by active exercise and a system of management calculated to promote health.

The accumulation of those hereditary tendencies which are most suitable for the circumstances of each individual case is in a great measure under our control, but it must still be looked upon as only one portion of a general system rather than as embodying all that is necessary. It is an important adjunct to other points of good management which are of great value to the breeder if judiciously employed, but at the same time all his efforts in this direction will be of no avail unless assisted by his general course of management. Valuable as a good pedigree may be when combined with a healthy and vigorous body, when the latter is sacrificed to attain the former, the value of pedigree is questionable. By avoiding excessive fatness in our breeding animals, by encouraging exercise and moderate exposure so as to favor the health and energy of the body, and by giving a liberal but regularly progressive supply of food, we shall best prepare our stock for being recipients of those hereditary powers to which I have here made reference.

"THE LESSONS OF THE HOUR."

LAST AGRICULTURAL ADDRESS OF DR. EZEKIEL HOLMES,

Delivered before the Kennebec County Society, at Readfield, Oct. 20, 1864.

INTRODUCTORY NOTE.

The following address was found among the papers of the late Dr. HOLMES, and while being gratified to give it a place in this part of my Annual Report, I regret that it could not have been obtained in season to have been placed in connection with the transactions of the County Societies. It will, however, be read with interest, as being the last address delivered by him. Although evidently imperfect—portions were probably extemporised at the time of its delivery—I choose to give it as nearly as possible in the form in which it was left, adding only a few words, in some instances, to make the sense complete. Upon the back of the last page is the following: "Last Ag. Address of E. Holmes deliv. at Readfield in 1864"—and evidently penciled with his own hand. On a sheet like that upon which the address is written, though it is not paged, is the following paragraph, which was probably delivered in some part of the address in connection with off-hand remarks upon the same topic:

> "What but a lack of public spirit in reference to our agriculture hindered our crops from equalling those of Genesee?—our cattle from rivalling the Bakewells, the Teeswaters, and the far-famed Durhams?—our flocks vying with the golden fleeces of the Escurial and the Saxony?—and our horses from outstripping the coursers of Arabia in speed? Why is it that canal boats are not winding their way among the mountains, and steam carriages coursing upon our railroads?"

One of the first lessons incident to every country that has been cultivated any length of time, is the necessity of accumulating and applying fertilizers.

Our soil, however rich it might be when first subdued and cropped, becomes more or less exhausted and requires replenishing with new material for feeding whatever plant or vegetable you wish to raise upon it. Every farmer if he does not know this in the beginning, soon finds it out to his cost.

Since the inauguration of this Society, many kinds of fertilizers have been introduced and recommended, such as,

Guano, from the Chincha Islands;
Poudrette;
Super-phosphate of lime.

I shall not trouble you with any details of their composition or use. I have tried them all. They are all good, if pure; but after all you will find nothing equal to the old and long tried and never-failing barn yard manure. All of us cannot however obtain a sufficiency of that; it is necessary to supply the deficiency with other material. I will trespass on your patience by enumerating and speaking of two only, and first of muck.

The state of Maine is rich in muck, and the proper use of it would make every farm rich. There are several modes of preparing it.

Statement of Moses R. Wentworth:

"I dig the muck as soon after haying as I can, that being generally the driest season of the year, and the sun and air will have good effect upon it before I take it to the barn yard.

Before moving this muck I clear my barn yard of the previous year's accumulation of dressing, say on first of November or before the ground freezes, carting it out into the field where I propose to plant corn next year, or for any other purpose, as top dressing, &c. I then haul into the vacant yard the muck and spread it evenly all over the surface. My cattle are then allowed to run over and stand upon it during the remainder of the fall and the winter. In the spring, as soon as it is dry enough, I run the plow through it and follow this practice often during the summer.

I have a barn cellar into which I drop the manure from my cattle during the winter and spring and whenever housed. This I fork over in the spring and during the summer, keeping it in the cellar until the last of August or first of September.

At this time I commence to mix the pile in my cellar with the muck in the yard in the proportion of one-third manure from the cellar to two-thirds muck in the yard, frequently plowing it over and incorporating them together as intimately as I can until it is time to haul into the field.

I stated that I cleared my yards just before the ground closed up for winter, and the sooner it freezes after it is out the better, as it prevents any evaporation or further drying. I drop it in a long pile and stack it into a sharp ridge like the roof of a house, flatting and smoothing the sides with my shovel, which causes it to shed rains, and you will find it all there in the spring.

Muck prepared in this way never failed to give me good crops, and proves more lasting for the hay crop than the same amount of clear manure does."

There is another fertilizer which every man may raise if he pleases, and one which, while it will afford forage for his stock, may be so used as to make the best forage for his land. Suppose you were told that in Holland, or any foreign country, the seed of a certain plant could be obtained which scattered over your land would in a year or two increase its fertility seven fold, would not there be great anxiety to obtain it?

* * * * * *

Clover; value of clover hay.

* * * * * *

Give details of weighing the clover roots from a foot square of land (10½ ounces), 43,560 square feet in an acre: 16 tons and 1,922 lbs., almost 17 tons; general description of the composition of these roots; best mode of applying them.

Geddes' use of it.

* * * * * *

The call for men in the army takes from us laboring hands and converts them from producers to consumers, and consumers too of the most wasteful description. This therefore makes labor scarce among us, and at the same time increases the demand and the necessity for an increased supply of agricultural products, and one of the lessons of the hour is to learn how to produce this increased supply with our diminished amount of manual labor.

There is but one way to do it, and that is by pressing into the service agricultural machinery. Farmers have been proverbially slow and cautious in adopting machinery in their operations. But as necessity is the mother of invention, so also it is the prompter to the adopting and using machinery when invented, and it is worthy of remark that this scarcity of labor which has been felt has not only been the means of more new machines being invented within two years past, and more old ones hitherto little used being put in requisition, than has been for ten years previous.

Such has been the call that the several agricultural implement manufacturers throughout the country have been pushed to their utmost stretch and not been able to answer all the orders that have come in, and yet there are those who still hesitate about adopting anything of the kind over and above what their fathers used. This is not wise. It has been found to be good policy to put into service labor-saving machinery, propelled by horse or ox or any other power, even if the work should not be quite so well finished as if done by the slower process of the human hand. Let us enumerate some of the facts and advantages within our knowledge, in regard to the introduction of agricultural machinery. The successful improvement and introduction of the thrashing machine is purely a Maine enterprise. Pope, of Hallowell, was among the first to invent a machine for that purpose, and introduce it to the attention of farmers. It thrashed the grain well, but it was a hand power, and it was found to be harder work to turn the crank than to swing the flail. What then was gained by his invention? nothing but the establishing of the principle that the scutching of grain by cylinders and spikes would thrash the grain clean if power enough were applied. Balon, of Livermore, caught this idea, and endeavored to put this principle into successful practice by constructing a spike or scutching cylinder moved by horse power. This power was applied to an old-fashioned cider mill sweep, the horse going round and round in a circle, with but simple gearing. This was found to be too slow and finally given up. What then was gained by his invention? nothing but a confirmation of the fact that a scutching cylinder moved by horse power would thrash clean, but there must be great speed. Sam. Lane, of Leeds, who had bought Balon's patent, found himself ruined by its failure, and finding wherein the machine was lacking, and having nothing more to lose but everything to gain, set about making one of his own contrivance which should have both speed and power to accomplish the work. So he got up the endless chain horse power with high gearing to his cylinder, and this accomplished the work. And yet after all, the farmers were loth to patronize it at first. I had something to do in assisting him to get his patent, and to induce a few monied men to form a company with him and push it into use, and to my certain knowledge that company had paid out *twenty thousand* dollars in getting that machine into use before they received a single dollar in return. But their perseverance was finally rewarded, and they made money by the investment. And I look upon the Lane thrashing machine as having the honor of first inducing the farmers to have their grain thrashed by horse power, but of also thrashing the farmers into a better appreciation of the benefits of machinery in facilitating their operations.

In a few years this machine, which many considered to be too fast, was complained of as being too slow, and the Messrs. Pitts of Winthrop, conceived the idea of making a wider endless chain of wood, and mounting two horses upon it instead of one, thus doubling the power and the speed. This superceded Lane's machines, and the Pitts machine soon had the field to itself. For a time it gave satisfaction, but the cry soon arose that it was not fast enough. The winnowing and clearing off chaff had to be done by hand, and after a pile had accumulated, the horses had to stop until it was cleared away by the winnows. The Messrs. Pitts again set their inventive faculties to work, and in due time the Separator, as it is called, was produced, and you could thrash and separate the straw and winnow the grain and bag it up if you pleased all at one operation. Thus by successive steps did the present thrashing machinery arrive at its present state of perfection, and although farmers at first were incredulous as to its operation, and took hold slowly and cautiously, I think they would not like to go back to the old system.

This lesson is being repeated now in regard to machinery for cutting and securing hay. The horse power mowing machine has been for several years undergoing improvements as to its own operation and improvements as to the utility of it in the minds of farmers, but not until the past season has the call for it been equal to the manufacture.

This year more have been called for than could be made. This year too has seen two new inventions put into successful practice which fill up the requirements hitherto made for a complete suite of apparatus to do away with hand labor, from mowing to stowing the hay in the barn.

The mowing machine and the horse rake for a time were all that we had. The spreading and the pitching on to the cart in the field and from the cart on to the mow, had to be done by hand, and rather severe labor it is. A few years ago, the horse pitch-fork for unloading in the barn was invented, by which a ton can be unloaded by horse power in five minutes, and it is slowly coming into use. Now a horse and a boy, or a man, can do all your haying in less time, and the same amount that ten men can do. First comes the mowing machine, the driver leisurely riding and smoking his pipe or whistling Yankee doodle as the team moves along, and the grass falls before it. Then comes the hay tedder or spreader that tosses the hay about, opening it to the sun and the breeze faster than ten men could do the same, the driver also riding at his ease as he guides it over the field. He then mounts the horse rake,—

the best of which are Maine inventions,—and gathers the hay into winnows, and now instead of bending and sweating over the pitchfork with aching sides and broken back to pitch it on to the cart, all you need do is to attach Bentley's Hay-loader to it, and as you drive by the side of the winrows, it will gather them up and deliver it in the cart as fast as two men can stow it about, and when in the barn the horse pitchfork will unload it in double quick time and your haying is done. Verily the day is at hand when by the use of these appliances, haying, which is now considered the severest labor of the year, will become a mere pastime. Only think how many hands and how much hard and grinding toil can be dispensed with by the use of these implements. And to use them it is not necessary that your farm should be level, but its surface should be made smooth and clean of obstructions, and it pays to do that even if you are to use only the common scythe and hand rake.

There is another suite of Agricultural machinery brought into action during the year which bids fair to greatly facilitate and increase the culture of another of our staple productions. I refer to implements for planting, hoeing, and digging potatoes. Maine is the home of the potato, and our potato crop rules the market in half the states of the Union. Anything that will diminish the labor and increase the produce, should receive the approbation and the encouragement of our farmers.

In this too the inventive genius of our Maine boys has been successful. Joseph L. True, a young man in Penobscot county, after several years of patient experiment, has invented and brought into practical use, a machine by which a man and a horse can plant in a thorough and efficient manner twelve acres per day. It cuts the potato, makes the furrow, drops the potato into it, covers it, and rolls it, all at one operation. Chandler, another young man of the same county, has invented and introduced a horse hoe which is an admirable implement for hoeing and hilling the potatoes, doing it as fast as a horse can walk. I have used both and know them to be what is recommended of them. Chandler has also invented a potato digger which is well spoken of, but I have not seen it. I did see, however, a new potato digger at the Springfield show, invented by a Mr. Hickock of New York, that I know will dig potatoes well, throwing them up from the hill, shaking and separating them from the tops and dirt, and spreading them out on the surface of the furrow, ready at hand to be picked into the baskets. Here, then, the former slow and somewhat tedious operation of cutting and planting, of hoeing and digging that useful and almost indispensable esculent, can be done by any old horse with a steady boy to drive and guide him.

In connection with these facts, I wish to mention one in regard to the vegetable physiology of the potato which may be new to most of us, and which has been developed by the use of the potato planter. We have all been in the habit when cutting potatoes for planting, to be careful to have an eye on every piece, supposing they would not come up if there were no eyes upon them. This is not the case. A piece with an eye on it will come a little quicker to be sure, than one that has none, because the germination is so much advanced, but the one without the eye will come too. We last spring took a potato and pared skin and eyes all off clean and planted it, and it came up nearly as quick as a whole one planted at the same time near by with all the eyes upon it untouched. We also planted a piece at the same time on which there was no visible sign of an eye, and that too came up, though not so soon as the others. It seems therefore proper to infer that the organization of the potato is such, that its germinating powers are not dependent upon the eyes, but that when these are destroyed, it will push out from some other part, the tubes or organs permeating the whole substance of the tuber, and not confined particularly to the eyes, or any one part of the mass.

One word more in reference to Agricultural machinery. It has been found that such machinery is more readily adopted and more highly appreciated by those farmers who have a little spice of what we Yankees call "*mechanical gumption*" in them. Now as every Yankee is supposed to have a pretty good portion of this talent, by way of birthright, and it follows, in order to induce them to come more readily into the adoption of such machinery more generally, the education of the young farmer should at some time be more specially directed to the subject of mechanical philosophy, and this opens to us another lesson of the hour, viz: the education of the young farmer with reference to his future occupation. It is a subject at all times of the utmost importance, but at the present time one which demands your immediate and special attention. And why? You are all aware that after years of importunity, Congress has set apart and appropriated a large portion of our public lands for the purpose of endowing an Agricultural College in every state in the Union. Most of the states have accepted this boon, and are stirring themselves to put their colleges into operation. The portion allotted to Maine amounts to nearly $100,000, and it is for you farmers to say how it shall be disposed of.

* * * * * *

PLAN OF STUDIES.

* * * * * *

[NOTE —Here follows a blank page in the MS. copy. His remarks under this head were probably given off-hand, and never committed to paper.]

" The best method of Education is that which combines the highest possible improvement of all the powers of the individual, physical, moral, and intellectual. A neglect of either of the three destroys the symmetry of perfect development. A pure atmosphere, with habitual exercise, are requisite to construct a healthy body ; without which, however great may be the extent of moral and intellectual culture, the individual is thus unfitted for usefulness, if not for enjoyment. Man is a being of habit. The boy who is to become a man of business, should acquire the requisite habits while young. He must learn to use his hands in useful labor; it will strengthen his frame and give him a more perfect development. But this is not all; it will teach him practically how to take care of himself, not simply to keep out of harm's way, but how to overcome obstacles, how to apply means to ends, to master other minds, to act with energy and decision, to get a living in the world where others would fail, and accomplish in life the greatest usefulness. And what *useful labor* can be more appropriate, while the boy is pursuing his academic studies, than Agricultural and Horticultural employment? These occupations lie at the foundation of all wealth, and are the fountains of all good economy," and give dignity and importance to his character and life.

In connection with this subject permit me to say, that although the time has gone by when it was deemed both necessary and expedient to urge upon the farmer the dignity and importance of Agriculture, for you all now know that as well as anybody else; you all know also the value of knowledge and science, not only to your own particular calling, but in the general relations to other pursuits, yet I trust you will excuse me if I call your attention to certain occurrences of the day, which have demonstrated, and will demonstrate as long as history shall be read, of what vital use and importance to the welfare and preservation of the nation, the farmers have been, and always will be.

It is now more than thirty years since the publication of the "*Maine Farmer*" was commenced in this state. Just before the issuing of the first number, John C. Calhoun commenced his nullification experiment in Charleston, S. C. Happily there was a man then in the Presidential chair who knocked the whole scheme over with one slap of his hand, and would have hung the author and father of it as high as Haman, if friends had not interfered and persuaded him to let him go. There was much excitement at the time, and, although neither a prophet nor the son of a prophet, in addressing the farmers on the occasion of presenting the first number of that paper for the patronage of the farmers and mechanics in Maine, I ventured to say in allusion to the troubles of that date, that they should teach us, that however dangerous to freedom may be the schemes of such men, the ignorant and uninformed will be unwarily induced to aid and abet their unhallowed designs, and that we should not suffer nor consider the greatness of our country to be based upon a foundation which could thus be sapped by political corruption, but that it should be based and founded upon an active, intelligent, enlightened yeomanry, upon men whose hopes and the hopes of their children are attached to the soil. How can this enterprise and this intelligence, which is so important to the stability of the nation, be better developed, than by the study and practice of an art which gives so wide a scope to comparative sagacity and brings its conclusions to the test of immediate experience?

Who will cling faster to his country than the farmer? Engaged in his peaceful occupation, remote from the allurements of political ambition, his mind untainted by sordid desires, and surrounded by all that is necessary to his comfort and happiness, and his soul expanded with gratitude to his maker, he will become more and more devoted to his home, his country, and his brother man, and while he looks with calmness and pity upon the machinations of unprincipled aspirants, will interpose to *heal*, to *defend*, and to *save*.

Now mark how these suggestions have been verified. Time, in his ceaseless rotation of years, at length unhappily brought about the day and the hour when the serpent of nullification and secession, which Gen. Jackson had stunned but not killed, recovered its strength and its wrath and involved us in a civil war of unheard magnitude and ferocity.

Who then sprang more cheerfully and gallantly to the rescue than the yeomanry of our land? More particularly have we been and still are, indebted to the agricultural strength of our country, which has covered us like the shield of Jehovah, giving us through his goodness and guidance sustenance for man and beast, and munitions of every kind for our temporal salvation thus far. To the labors of the farmers are we still indebted for safety and for succor, and for comparative plenty and abundance within our borders.

Nor is this all. To this abundance which they have produced, are we indebted for continued peace with the European powers, the governments of which deeply sympathize with the rebels and would openly have aided them in their attempts to overthrow our Republic, had it not been for the farmers of the Union.

This may need a little explanation and I will give it. For the first two years of the war, the grain crops of Europe were partially cut off, while ours were overflowing. According to their own statistics, their deficiency was such that they had to import into England each year one hundred and six million bushels of grain, nearly one half of which came from this country. The British Board of Trade reported that in 1862 they imported from us more than fifty-two million bushels of grain. Only think of this, and think of it too in connection with the war troubles that we were opposing. Just think, that while we were carrying on one of the most terrific and gigantic wars at home, we were at the same time feeding the starving millions of Europe at the rate of one hundred and forty-two thousand bushels per day? Farmers! let this fact sink deep in your hearts; let it nerve you, strengthen you, and encourage you in your rugged toil; let it lead you to contented industry and remind you, that in all your honest labors you are doing your country and your God good service; that every potato you dig, every ear of corn you raise, and every kernel of grain you harvest, adds to the prosperity, the power, and the perpetuity of the nation.

But there is another lesson of the hour greater and mightier than all the others,—the lesson involved in the great question that is now enlisting the attention of the civilized world, and in the conflict engendered by it that has shaken our country to its very foundations. This great subject absorbs the thoughts and agitates the hopes and the fears of all the people from the least to the greatest. It is a lesson of true patriotism. It is a lesson of that practical love of country which requires, not only a deep-seated sentiment in our hearts that our country is our real parent, which should be loved and revered and cherished with profound filial affection, but also a manifestation of that cheerful and unselfish sacrifice of all that we have, even to life, for its protection and its salvation. And oh, how grand, how mournfully, but sublimely grand, have been the developments of this earnest, this soul-inspired, life-sacrificing love of country throughout the length and breadth of our land. History in all its records of man, from his first breathing in the garden of Eden, down to the present hour, has nothing like it.

We were a people unused to war for nearly a whole century, with the exception of a few years of warfare, and those at a distance from our borders. We have had no call to arms. With quiet and assiduous industry we had been cultivating both the sentiments and the arts of peace; no strife of arms either domestic or foreign had disturbed us, and we had almost begun to believe that the temple of Janus was shut, and the war god had gone to sleep never to be waked again, when suddenly he rears his grizzly head in our very midst, and blows a blast that shakes every hearthstone in the nation. Patriotism was something we had read of and admired in our fathers; a sentimental theory in our minds cherished as a speculative virtue and suffered as such to lie dormant within us, and become rusty as it were because of no necessity for calling it into tangible demonstration. But thank God! it was not dead but only sleeping, and when the first gun of Sumter burst over us like a crash of thunder, it leaped forth like a young giant from his slumbers, and stood forth with an energy and a strength that has astonished the world. From the bleak and rugged hills of New England to the teeming prairies of the West; from the rock-bound coast of Maine to the farthest slopes of the Pacific, the sons of freedom and human rights came together like a band of brothers to the rescue, and have battled like veterans for the preservation of the Union and the Government whose foundations were laid by our fathers and cemented with their blood, and like their fathers thousands and thousands have counted their lives as nothing if so be they could save their beloved country from the degradation and deep damnation to which our enemies would sink it.

All honor to our brave brothers who have died that we might live; and all praise and thanksgiving and glory to God, who has thus far protected our country and its time honored institutions of universal freedom, and who will continue to protect them so long as we honestly ask His aid and walk according to His precepts.

He will give us success, and you will find it to be one of the lessons of the hour, and a lesson that future generations will not dare to forget, that God has no attribute to bless and uphold and to preserve those who seek to found a government upon human bondage as its corner stone. Some may talk as they please, but they cannot disguise the fact, and the world now fully understands this fight to be waged for the protection and perpetuation of slavery on the one hand, and human rights and human freedom on the other.

THE BREEDING OF HUNTERS AND ROADSTERS.

BY J. GAMGEE, SR.

[*A Prize Essay, from the Journal of the Royal Agricultural Society of England, Vol.* 24, 1868.]

NOTE. The English Hunter is not a distinct breed, but is the result of a judicious crossing of breeds, together with an equally judicious system of management in rearing. It is without doubt the best horse for general purposes in England, and has more resemblance to our best horses for the road than any other breed. The following essay from an eminent English Veterinary Surgeon, is one of the best treatises ever written upon the subject, and is worthy the studious attention of every farmer.

The subject to be treated of in this Essay is one which will undoubtedly repay the agriculturist for any amount of attention and skill which he may devote to it.

In aiming to produce a horse of that stamp which will realize the highest price for hunting purposes, the breeder is on the safest way to exclude the chances of failure; because the animal which just misses the character of the first-class hunter is of a quality which is available for the greatest variety of purposes, either for saddle or harness, or for recruiting the military depots of the nation with the horses best suited for the service.

The subject requires to be considered in its economical as well as in its scientific and practical aspects. No amount of foresight will enable the breeder of hunters to obtain his highest aim with more than a fair proportion of his produce. In order, therefore, that a profit may be realized, the average horse must pay its expenses; those of a superior quality will then leave a good surplus gain, of which part will be required to cover deficiencies arising in a few inferior lots. This law of compensation applies to the breeding of horses of all classes; but its range becomes more extended as the stock rises in the scale of value; so that in breeding for the Turf, where the real prizes, when secured, run very high, the failures—weeds as they are called—are most numerous and most unremunerative. Therefore, the more generally useful the class of horse is which the breeder aims to produce, the less will be his risk, the greater the probability of profit if proper means are employed. When breeding is conducted on this principle, the type or model especially sought after is that of the noble weight-carrying hunter.

To define what is understood by the term *hunter*, it is necessary to go somewhat at large into the character of English horses, the different breeds or classes into which they are divided, and also into the history and progress of the race. The hunter has at no time constituted a distinct breed; in that respect he differs essentially from the pure blood-horse, whose genealogy has alone a reliable record. The long-established renown of the English and Irish hunter has depended and must depend on the judicious crossing of breeds, with equally judicious management in their rearing, as well as on the judicious development of the breeds thus blended together. That some thoroughbred horses make clever, nay, the best of hunters, does not alter the proposition just laid down, because they form exceptional specimens.

The hunter is required to possess power, speed, and endurance in combination, to fit him for the stiff country he may have to cross, and for the high weight he will have to carry; but few thoroughbred horses can be found capable of fulfilling these requirements, and still fewer of these are generally available for the purpose, since the turf and the stud monopolize such choice specimens. If there be some gentlemen who, having no predilection for the turf or for breeding, prize good hunters so highly that they secure a few thoroughbred colts of the highest stamp for this object, still this source of supply is limited, uncertain, very costly, and prejudicial to the public interests.

If the whole number of blood-stock bred in England, in any given year, were looked over when yearlings by good judges, less than 10 per cent. of them would probably be pronounced likely to make hunters able to carry 14 stone; and if it were possible that a few of the most powerful of these could be secured for the purpose and converted into geldings, as in most cases would be necessary, our supply of hunters would be but little extended, whilst the process would sap the very foundation of our breeding establishments.

If only ten of the best-looking stout yearlings were annually picked out, amongst them would be comprised those of the 'Stockwell' and 'Voltigeur' class, and thus the standard of the horses to which breeders must turn for purity and stoutness would at once be lowered. All such exceptionally good horses as are here contemplated, whether bred or bought, would cost the owner probably £1,000 apiece before they reached the age, or had passed through the changes and ordeals necessary to make the hunter. Although the training-stable may readily mount the light-weights, or even furnish brilliant chargers for the army, it is only by forethought and good management applied to cross-breeding that men of heavy weight can be adequately supplied with hunters. Size, substance, and power, with sufficient speed, may thus be secured, whilst in symmetry nothing, perhaps, may be wanting.

The history of the English hunter goes farther back than that of fox-hunting. The various accounts given of the Roman conquest of Britain inform us, that even then, England furnished good horses, and that, some 1500 years before we had any authentic record of the importation of Eastern blood for the improvement of the native breed. We have had, then, an old English race of horses, the history of which is lost in the distance of time; and from that stock, no doubt, the stamina and peculiar character of the English hunter of all times has been in a great measure derived. Moreover, if we take into account the fact that the natives of Britain have always been skilled in and pre-eminently fond of the chase, we may reasonably infer that they cherished and prized horses suited for that purpose when hunting was a national service no less than a sport and pastime.

It may be true that men in our own time take to themselves too exclusively the credit of attention to improvements in horse-breeding. The answers which History, when impartially studied, gives to our inquiries, often tell two ways, and with a benefit received, exhibits an attendant drawback. When the land is placed under cultivation, and the animals that feed on it are brought under the control of man, their condition is improved or made worse, according as the artificial system has been carried out, — that is, with the consciousness that every infringement on Nature's laws by man calls for compensating art and labor to devise and supply means which may counteract the evils arising therefrom, — or the reverse has been the case.

When people, taking a contracted view, contrast the English horse of the present day with the poor, rough, uncared-for creature they imagine he must have been in ancient times, they support their argument by reference to the little animals still found in some parts of the kingdom, the New Foresters, the ponies of Wales, and of the Shetland Isles. But in this they totally overlook the influence which a great change in their destiny has exerted. Unlike the larger and nobler horse, when he was free, the modern forester and mountain pony has been driven from the fertile plain, and doomed to live on sandy and boggy wastes or to share with the goat, the deer, and little sheep the scanty vegetation of the mountain. Though such has been their lot for centuries, yet how perfect the form of many of them! how sound their constitutions and limbs! and how wonderfully their size has become adapted to their subsistence on scanty provender, whilst exposed to all kinds of weather!

The climate, soil, and topography of Britain were, it is reasonable to believe, as peculiarly congenial to the horse in early as they are known to be in modern times; hence the superiority of English horses over those of most other countries. With extensive tracts of natural pasturage, large forests, mountain and dale alternating, the horses of olden time found abundance of food, with shelter and shade to afford protection in all seasons. Horses so situated, we know, migrate in numbers together from mountain to valley, and *vice versa*, as the seasons change, and as the requirements of food and variations of temperature prompt their instincts.

The old stock of English horses must have received periodical additions, at various epochs, in ancient times, from Continental nations. We are especially informed that some four thousand cavalry constituted part of the army with which Julius Cæsar invaded Britain; and the Norman and other invaders, besides the Romans, naturally brought their horses with them. Under the influences of a soil and climate congenial to his nature, it may be inferred that the imported horse improved by the change, and that fresh importations of stock wrought progressive changes in the whole race, and from these combined influences the characteristic stoutness and other special qualities of the English horse were established.

We have, however, to search far down the history of time before we find any distinct record of the importations of horses from the Eastern nations and the south of Europe. Early in the 17th century, King James I. bought of Mr. Markham an Arabian horse, imported from the East by the latter. This horse is reported to have been the first of that breed ever seen in England; but it would be hard to establish the truth of this assertion. Since Britain long continued to be a dependency of Rome, herself the mistress of the whole civilized world, so that lines of communication were constantly open from east to west, and especially traversed by the armies of the Empire, is it not probable that Roman officers availed themselves of opportunities of possessing Eastern horses, and that some of these accompanied them into the far West? To show that the English horse was of no mean character, when the Arabian above alluded to was brought over, I will quote the authority of one who was generally reputed the best judge of horses of that time. The Duke of Newcastle, speaking from his own knowledge, "describes the Arabian which was imported and sold by Mr. Markham to the King to have been of a bay color, a little horse, and no rarity of shape." (*Beranger*) The value to be attached to the above quotation is the evidence it affords of the relative high standard of the English horse of the time.

In devising means to establish the best possible stamp of hunters, our wisest course is to take systematically into consideration the prevailing defects in the breeding of the several distinct classes of horses from which the supply is derived, more especially those classes whence the most powerful and active mares should come. Disregard for the equilibrium to be kept up amongst these several classes has been a potent cause of the falling off in the number of good hunters of late years. During the progress of descent through successive generations there are always agencies in operation which tend to make horses become lighter and lose stamina, unless rational management keeps the stock strong and pure. Simple neglect produces deterioration, especially if it leads to the use of a bad stallion. Bad blood-horses have been too much used, and mares of their stock too often retained to supply the places of their dams and grandams, while the sale of the latter has often proved a permanent loss both to the breeder and to the district to which they belong. With the increased demand for exportation of the finest mares, the difficulty increases of supplying their places, and even producing stallions of their class; indeed, the course of events leads rather to total dispersion than to mere deterioration or numerical scarcity. Though I submit that good blood-stallions are alone reliable for the production of hunters, and that the mares should also be closely up to the required standard for speed, and whilst power and stamina should form the leading features in their character, I am in no way inclined to dogmatise on the exact amount of pure blood which affords the best promise of combining all the essentials in the clever hunter.

The meaning which the words "half-bred" and "three parts bred" commonly convey, whether used technically or literally, is most inexact and vague. We may instance "The Lawyer," a horse still in training, which has proved himself to be one amongst the very best horses of his year; yet he is called a half-bred horse, though he has descended from the choicest of blood-sires for six or more generations, and on the dam's side to the remotest point to which the pedigree can be traced. The first ancestress named is the renowned "Jenny Horner," considered the best cocktail of her time, and that some sixty or seventy years ago. It would seem that Sir Tatton Sykes bred from "Jenny Horner's" descendants, and at an earlier period used them as hunters. The question is thus opened whether some of the most promising amongst the intermediate line of produce might not have proved successful racers, as it was only through the accident of his being trained that "The Lawyer" was found out to be the speedy animal he is.

I believe that to place horse-breeding on a secure basis the pedigrees of more than one recognized class should be kept for public reference, in the same way as the General Stud-Book has been for the blood-horse during more than a century and a half. The word "difficulty" stands in the way of all new measures; but the way to set about establishing such a register was never so plain as now. The Royal Agricultural Society of England, the Royal Highland Agricultural Society of Scotland, and an analogous Institution in Ireland could together accomplish more good in the direction indicated, within a few years, than could formerly have been effected in a much greater length of time by a long series of trials.

The example set in the establishing of herd-books, and registrations of the produce of greyhounds and other dogs, encourages me to think that the difficulty in the more important case of the horse is more imaginary than real. Indeed, the longer period during which the horse lives and continues to propagate, and the relative slowness with which changes are effected in the race, render registration in their case more easy as well as more imperative. If the question be raised, how shall we get a satisfactory starting point? our past history will give the best answer.

The important step taken under the auspices of, and by command of Charles II., in the 17th century, with reference to the blood horse, might have been deferred indefinitely, had not the scruples, which in every similar case present themselves, been overcome. At that time a commission was issued to select and collect a number of the purest mares and stallions of oriental descent that could be found. These formed what was called the Royal stud, the nucleus from which sprang the far-famed English blood horse. The wisdom of this measure has never been questioned, neither has the way of its execution.

The original blood-horses evidently did not all come from one particular stock. Damascus and Aleppo supplied some; but apart from traditional history, we can still trace in the stock of the present day some specialities in the character of the different lines which indicate a distinctive origin. Blacklock and his progeny stand in remarkable contrast to Whalebone and his, exhibiting the special characteristics of their ancestors, whether they be traced back to Highflyer and Herod, as the representatives of the stronger outline, or to Eclipse as the representative of the finer Arabian cast. Yet the finer shades of difference which the subsequent intermixture of stock of different qualities has produced, exceed our powers of discrimination.

The position of our colonies may afford us a useful illustration of the manner in which a register for any breed of horses may be started. Such colonies as Canada, Australia, New Zealand, the Cape, &c., are in many respects as well adapted to the horse as the mother country. It is as important for these States, as for ourselves, that horse-breeding should go on systematically, and not be left to chance. They have, therefore, strong inducements to form a register; but their own peculiar uses, predilections, and climates, will determine the character of that register, as well as that of their purchases and general management. It seems just as easy for any of these to begin with two or more Clydesdale mares and stallions, certified as of pure caste, by the Highland Society's judges, as to begin with blood mares and stallions, vouched for by the stud-book; in both cases a new register begins; and if, instead of these two classes, Yorkshiremen should take their Clevelands, the Norfolk farmer his trotter, the Suffolk man his punch, and the Irishman his hunter, it is not apparent why these several classes could not be kept pure, and crosses afterwards carried on with a knowledge of what was being done, and consequently a more correct anticipation of the result. If this could be done in the colonies, there can be no valid reason urged why it cannot be effected in this kingdom.

Greater changes have been made in the breeding and management of horses in England during the last fifty years than in any similar period on record; but these have not rested on any sound basis. Horse-dealers' suggestions, capricious demands which temporarily influenced the market, have led men to alter their conduct with as little consideration as they changed their vests.

Few good judges, and especially among those who can remember longest, see reason for congratulation on comparing the present with the past, particularly with reference to the hunter, and the high class hack, and carriage horse.

Meanwhile in those animals which propagate and therefore multiply more rapidly, such as dogs, pigs, fowls, and even sheep, great changes have been effected by individual enterprise in a few years; whilst the horse, the favorite of princes and nobles, appears to require to be specially fostered by the patronage of the great, or by union and concert among the many.

Hunters have usually been identified with the country in which they are bred. We pronounce a horse to be of Yorkshire, Shropshire, Norfolk, or Irish breed, from his characteristic form; but these have had in the main a common origin, represented in the blood-horse; though the influence of soil and culture together, in great measure, fixes their character and decides their worth.

Too much stress cannot be laid upon the judicious management of mares and foals: with care useful horses may be reared from indifferent stock; whilst without it, the produce, though well descended, will not be worth their cost. In feeding young stock, extremes should be guarded against; liberal keep, on sound grass, with corn and hay in moderation, proves the most economical in the end. If more food be given than the system can assimilate, superfluous bulk will be produced at the expense of strength and stamina, and the digestive system will be deranged.

The same rule applies to exercise, shelter, and warmth; for the first, space and liberty are essential, and as regards temperature, it is neither practicable nor desirable for horses that it should be constantly equal. Wet and cold, however, are uncongenial to horses, which should be provided with means for at least voluntary shelter.

If horses be properly fed, are protected from rain, and have a dry surface under foot, with space for voluntary exercise, the temperature of an ordinary winter is salutary to them. The horse's coat, then, with the secretion going on over the surface of his body, equalises and regulates the bodily heat. Horses in a roomy paddock do not suffer from a shower in summer any more than schoolboys in a cricket field; but long exposure to rain in a confined space is injurious to them.

The question of blood *versus* bone is so often raised without receiving any satisfactory solution, that I am induced to make a few remarks on it.

The practice of cross-breeding is constantly resorted to by farmers, sporting and amateur breeders of various animals, all of whom have evidence to show that they can produce certain desirable qualities in the offspring which neither of the parents possessed. The mule may be referred to as a case in point: here we find the produce much superior in size, power, and action, to the ass; whilst its continuous powers of endurance under exposure to weather and privations, exceed those of the class of horse to which his dam belonged; this superiority is in part traceable to differences in physical conformation, and in part to the temperament resulting from a combination of races. In this case, however, nature has, as is well known, set a boundary to modifications of race, which protects the noble horse from becoming an utter mongrel.

Breeders of dogs obtain, even in the first cross, courage and larger size for hunting and other uses without the sacrifice of reliable exactness; those breeders, however, who succeed best, are most careful to select from types of the purest blood on either side, and without the English bull-dog, the means of producing many of the most useful specimens combining high courage and great strength with other requisites, would be wanting.

Since different classes of English horses varying in height, form, and power, are available for breeding hunters, these can be more readily brought to any standard desired than any particular race, even the blood-horse; power, speed, and bottom, are the first requisites in the hunter, in whom, if the first two qualities are combined, the last or staying power usually results as a consequence.

The height best suited for the hunter required to carry a given weight, is a point on which turf statistics throw but little light. The Derby is sometimes won by a horse more than 16 hands high, and a little less frequently by one under 15, but in the majority of cases by horses which measure between 15 hands 2 inches and 16 hands; so that 15 hands 3 inches may fairly be laid down as the nearest standard height of the blood-horse; and within an inch under or over that standard will be found eight-tenths of the best race-horses and blood-stallions in England.

An attempt to produce horses of any given class much above its normal standard, will, with few exceptions, be realized at the expense of symmetry, action, and power, the latter being dependent on form. Where great power is required, and some of the speed of the race-horse can be dispensed with, the well-chosen blood-stallion may be put to a stout, well-formed, well-bred hunting mare, with a probability of the best result.

One of the greatest errors that has been made in the employment of thorough-bred stallions for country mares has been the preference given to the largest horses exhibited, particularly if these spurious monsters had a pedigree going back to "Eclipse" or "Childers." As a rule, the overgrown thorough-bred stallion, *i. e.*, those of about 16 hands 2 inches, have done harm in the counties where they have travelled.

When the powerful half-bred mare bleeds to the blood-horse, there is always a disposition in the produce to increase in height and length. Some of the largest, ill-formed, and least useful horses have been the produce of bad, overgrown blood-horses, and Yorkshire mares; the stock often exceeding 17 hands in height. On the other hand, the old Cleveland horse, on short-looking legs (short because of his deep and wide frame), measures, when of the best form, about 16 hands; and from mares of that stamp, and a good blood-horse of 15 hands 2 inches, it is easy to produce in the second or third generation hunters which could carry 18 stone over a heavy country, and jump double fences, despite the ground and weight. Though the present requirements of Leicestershire can hardly be met by one or two crosses of blood, still it is important to know how size with good form may be had when wanted.

In selecting a mare to breed hunters, form is usually more regarded than pedigree; not that knowledge of descent is unimportant, but, because with all but blood-horses, it is commonly so very hard to go far back — nay it is good policy, when doubt arises, to stop inquiry, *lest more than the truth should be heard.*

Young mares should be selected in preference to aged and hard-wrought animals; the latter being uncertain till tried. Exception, however, should be made in favor of a mare of ten or twelve years, which had produced some good foals; if sound, she is in her prime. Those destined from the first for breeding, should be put to the horse, at three years old, instead of being left barren till a year or two later, as is commonly the case; if they have been well kept, they will be sufficiently developed at that age.

Mares of the stamp for producing hunters are very scarce now, as may be inferred from the small number presented at exhibitions of general stock; yet, with our climate, soil, and national resources, the few good animals still obtainable for breeding would suffice for laying a foundation, if breeders were encouraged to produce and keep stock of the right sort.

The real good half-bred stallion — such as we used to see, with his large clean legs, well-defined knee, hock, and pastern joints, with good head, shoulders, barrel, and hind quarters — is now become scarce; these horses, when about 16 hands high, formed a connecting link between the thorough-bred and the stronger classes: from such sires, mares fit to breed hunters used to be obtained, besides many of the most valuable horses in England for general purposes; of late years whenever such a stallion has made his appearance, it has only been to be favored with a few mares preparatory to his being exhibited, and then sold to go abroad. To find a really good half-bred stallion of this old stamp, at five years old, has to the writer's knowledge been a rare occurrence during the last ten or fifteen years, even in the first horse-breeding district of the kingdom.

To do justice to this subject it must be regarded both in its general and particular aspects; individual breeders who seek to promote their own particular interests, cannot be expected to take as broad a view of this question as constituted bodies like the Royal Agricultural Society, which is founded to promote national improvements; yet the breeder who succeeds in producing fine specimens of the class of horses best suited to his locality and requirements, will promote the general good; whilst by classifying and bringing them into notice, the Royal and other Agricultural Societies will do their part.

The breeders of horses are for the most part either wealthy amateurs or tenant farmers; to the latter we must turn for the general supply of every description, the race-horse excepted, though it must be admitted that English horses of the best type owe their state of perfection to royal, noble, and gentlemen amateurs. At the present day the stud belonging to her Majesty forms a model to all breeders; and to royal patronage was due the high perfection to which the English blood-horse attained during the last and previous centuries.

From 1750 to 1764 inclusive, three horses were bred in England, by His Royal Highness the Duke of Cumberland, uncle to King George III., which together did more to advance the value of the English horse, than any set of incidents on record. The horses alluded to, were Marske, King Herod, and Eclipse. If we pass over the first-mentioned horse Marske, because he was the sire of the last — Eclipse — we still have in the other two the elements of an entire reformation in the character of the blood-stock of the kingdom. The sons and daughters of Herod and Eclipse are unexampled for their character and numbers; and through these in parallel lines, we obtained such a stock as no other country has possessed. So effectual has been the patronage of those in a high station, in advancing the improvement of our horses, that whenever we search out the origin of any of our best blood-horses, without which the hunter could not have attained his special excellence, we find in almost every instance, some cherished historical name connected with him as the breeder.

One important point in which the rearing of horses at the present day differs from the practice of the last century, consists in the small paddock and artificial forcing management being substituted for the range of the spacious park, with the necessary adjuncts, until maturity was reached.

Amongst the essential conditions for breeding horses next to that of selection of stock to breed from, is the choice of the land as regards its nature and extent; to this point too little attention has been paid of late, and it has a special importance in the case of hunters, because they require longer time in pasture than others, to complete their growth and consolidate the frame.

When the subject of rearing horses on farms which contain little or no pasture, has been under discussion of late, and the relative cost of a young horse produced *in the farmyard* has incidentally been contrasted with that of one purchased of the same age, it has been argued that the price of the horse bred on the farm is not felt like the payment of all the money in a lump. It is strange that men of the sagacity of farmers should make any such exception to the broad commercial rule of exchange, which never applies more forcibly than in this case.

The first question for a man to ask himself, who has a desire to breed horses, is,—have I the necessary pasture land for the purpose? Without this nothing can be done in the matter; with it and the necessary capital everything can be accomplished. Good sound old pasture is that which admits of the best hunters being produced with the least help by artificial means; such land as grows the best wheat seems also to suit horses well—the North Riding of Yorkshire may be cited as a case in point. Well-drained land is essential, and a dry surface most favorable,—whilst wet flat lands may grow grasses and feed horses to a large size, hunters can never be produced on any other than good firm soil; if the surface be hilly, all the better; if some of these natural advantages be wanting, yet horses bred on sloping ground, where they have variety of exercise, become finer in form, with better action, than when bred on flat ground.

Many of the best horses known at all times have derived their high qualities from the physical character of the ground on which they were bred; the more extensive and diversified this is, the less risk there is of foals breaking a leg whilst galloping and playing in a confined paddock. I never knew of a similar occurrence where the young animals have had space and inequality of ground, to give them strength, with the will to use it.

With a regular supply of good sound food, horses may be bred to a very high state of perfection, on dry poor soil; so far it is a question of expense. I have seen horses bred on inhospitable ground, and there left to nature, which, after care has been taken to get them into condition, have become serviceable animals; but a horse bred on swampy ground, or confined in a soft, wet, filthy farmyard, or stable, may grow large and heavy, as they generally do, but can never be good for any purpose. Fine shape, good action, compact textures, with sound constitutions, and feet, such as will bear exertion, are requisites pre-eminently required in the hunter, and no class of horse should be without them, to the highest attainable degree; yet none of the above qualities can be acquired unless foals and growing colts have liberty on firm ground; this proposition is based on some of the fundamental laws of nature which cannot be violated with impunity.

The experience afforded by other nations confirms this view;

thus France, having few natural advantages, purchases horses for common use from Germany, and has recourse to England for choice specimens of valuable breeding-stock; Northern and Central Italy obtain their horses from the same sources. Even in England horse breeding is in great measure confined to some of the more favored counties, where the best can be reared at the least outlay for artificial means.

On some of the extensive tracts of land which belong to the Roman States, horses may be found under conditions which approximate to their purely wild state; within certain bounds they range and breed as free as the deer of the place, stallions and mares running together, *i. e.*, a stallion is selected for the season and turned loose with a certain number of mares: the market value of young unbroke horses, when so reared, depends greatly on the character of the ground; whilst colts bred on high land will fetch 300 crowns the pair, those reared at the distance only of a few miles on low soft marsh land, will realise only 50 or 60 crowns apiece. Wherever the matter has been tested, I have found that the character of the soil and general management influences the wearing powers of horses more than that of their parentage.

Where attempts have been made on the Continent to breed horses in small enclosed paddocks, such as in England are allotted for blood-stock, without the aid of the English soil, climate, &c., it has always proved a failure: the stock have been high on the leg, narrow, and without form, action, or good qualities of any kind. Where, however, the English stallion is used, and the mares have their native freedom on good ground, relatively good stock has been procured.

Change of ground is good for horses, for the fresh soil and herbage it presents, as well as for the variety of surface it affords. Land laid down in seeds, though inferior to old pasture, is often serviceable to the farmer as affording an extensive range of fresh ground.

It is not until the second summer that colts require more extent of ground than a small enclosed field affords; the young animals, if they have only an acre of space, will display their speed, by galloping round their dams in a circle. Colts and fillies destined to make hunters, require to have their liberty for three full summers; and it is a question to be settled by the means at hand, whether four summers should not be given. Hunting-colts should be taken up, broken, and be gently ridden at latest during the winter when they are rising four years old: they may then either be turned out again for two months during their fourth summer, or be ridden over the farm at that time, which, with a good rider and proper care, affords the best beginning for a young hunter: such usage is preferable to turning out, though both these courses may be followed in the same summer, to some extent, with good effect.

It is not necessary that the space of ground allotted to mares and foals should furnish all their sustenance during any considerable part of the year; most breeders of hunters, however, will be provided with such good grass-land as will make them independent of much other aid during three or four months of summer. To a great extent the same system that is adopted for the racing-stud may be carried on in breeding hunters; but the practice of running blood-horses at two years old has induced breeders to stimulate their growth and development by free and, I may say, excessive feeding.

To insure the best results, there is only one mode of procedure for different stock as far as the first and second summers, with the intervening winter, go. Whether the colt be entered to run for the greatest early stakes, or destined to carry the heaviest amongst the fastest of riders to hounds, or designed to make a stallion, ample space on good land, shelter and cleanliness, are essentials, without too much pampering; the food to consist of sound meadow hay and oats; to such an amount as the resources of the land, and the state of the animal indicate. Growth, form, and fine fibre, are our requirements in the horse; and it is by giving food of a kind and quantity which can be assimilated that these are produced: any excess in the quantity of food given adds to bulk and weight, at the expense of quality.

Thoroughbred foals and yearlings, under the present method of feeding, eat from one peck to one and a half pecks of oats per day; and of hay, either cut into chaff or in its normal state, about seven lbs. The motive for this, as I believe, excessive feeding, is not alone the prospect of the young stock being put into training at eighteen months old, but especially that of their being previously offered for sale. The object of primary importance, that of producing the most symmetrically formed horse, is thus made subordinate to the desire of turning out the largest yearling colt.

I am of opinion that if the quantity of corn given to some of the blood-stock was diminished to three feeds daily (a change which would induce them to eat a larger proportion of hay), their condition would be thereby improved, even for the time, and more obviously so for the future. What is required in the colt is thorough development of the muscular and nervous system, and of those organs which carry on the functions of nutrition; a little fat will be stored up, according to the natural law; but young horses should never be made up until they are what may well be called "beastly fat." To be liberally fed, so that there is no interruption to growth, their appetites and condition should be carefully watched, and the distribution of food regulated with judgment.

I disapprove of green food, such as vetches, clover, and other grasses, cut when in season, and given in large quantities to horses, of any class. Green forage so given has few of the properties which it possesses when horses eat it off the ground as it grows. In his normal state, the horse selects and masticates, so that the process of feeding is slow. Mown grass becomes first *welted*, then ferments, is stalky or woody, and when placed before horses under restraint, it is eaten voraciously; the stomach and bowels becoming overcharged, digestion is impaired. All grasses should be either eaten off the ground, or else, when cut, made into hay, whereby time is given for the consequent fermentation. When I make any exceptions to this rule, I am very careful as to the kind of grass, and its state when cut—it should be at the point of flowering: and the quantity supplied must be small on the whole, and nicely apportioned between different baits. These statements are meant rather as cautions than fixed rules. In town, the ill effects of giving green food are most marked, because there it is commonly given in an unfit state, through the causes alluded to. The same objections do not apply to roots, amongst which carrots especially form an excellent adjunct to good oats and hay, during a great part of the year, for mares and young stock of different ages. Scientific researches into the chemistry of food have not done much to modify the sound rules of practice long established in England on the feeding of horses. In 1860, the Cleveland Agricultural Society set the example of giving £100 to the best thorough-bred stallion for getting hunters: and the Royal Agricultural Society, by offering a like prize at its three last meetings, with similar conditions attached, has afforded further scope to the experiment, which has not as yet shown the promise of much fruit. Indeed, there now appear some signs, if not conclusive evidence, to show, that not only no good end is likely to result, but that this large prize tends rather to defeat the object for which it was so liberally set on foot. Without some annexed conditions, no guarantee is afforded that the recipient of the money uses his horse so as to make him available for the breeders of hunters and roadsters. The large prize has either fallen on a horse of high renown, which was serving mares at a fee such as none but breeders for the turf can afford to pay; or else it has been given to a young horse which should have won his way to favor gradually by his merits, and thereon the price for his services is increased to an amount which places him quite beyond the means of breeders of hunters.

Unconditionally as this prize is given, any one of the renowned stallions which covers at from £10 to £50 may be walked to the yard and obtain the prize, thereby deterring the owners of more eligible horses from going to the expense and trouble of bringing them to encounter defeat. The line of distinction drawn between the first prize-horse and his competitors is frequently also too broad; and this leads to discontent and complaint against the decision of the judges. The tendency of this prize, then, seems on the whole to be rather to deter than encourage the keepers of really useful country stallions. Indeed, it may be questioned whether the whole system of awarding prizes to stallions by the local agricultural societies of England for some years past has not tended to exhaust the means for procuring a good horse.

Prizes, when given without restrictive clauses, act as an advertising medium, to such an extent that the prize-horses of one year have very rarely been found in England the next season; and as premiums are usually given at the age of three and four years, the animal has been of little service prior to exhibition and sale: prize-mares go abroad as well as stallions; so there are few good mares to breed stallions from, and still fewer good stallions to get fillies.

It must be acknowledged that the blood-stallion has not been so much affected by these measures as the half-bred horse; whilst in the cart-horse class the system has worked well, inasmuch as there is little demand for them on the Continent; and the Scottish Agricultural Societies, particularly, take care that the horses, according as they obtain first, second, and third prizes, shall be located in such districts as the Society directs; and if the same course had been followed in Yorkshire and other districts in England, our beautiful nag-sires would have been retained for at least one season after their excellences had been publicly proclaimed.

In judging the classes of hunting and roadster or nag-mares, some more intelligible definition than has generally prevailed is wanted. Yet so closely do these blend one with another that it is difficult to draw a line so as to divide them into even two classes; there should, however, be a clear distinction between the hunting and the thorough-bred mare; the latter, if good, is kept to the paddock, and in a general way never becomes the producer of hunters. Moreover, the same objection applies to the mare as to the high-class blood-stallion; they can be walked into the yard simply to receive the prize; the racing-stud would furnish mares such as the dam of Kettledrum, which would carry off the prize, thereby deterring farmers from producing their best, and, moreover, set a wrong example, stamped by authority, as to the kind of mares which farmers should try to keep.

I may refer to an instance in point as an example; at the East Riding Agricultural Show, held at Bridlington about 1853, I saw the first prize for the mare for breeding hunters awarded to Hygeia, by Physician; that mare had never been out of the racing-stable or the stud. She had bred runners, but nothing like a hunter; and has since been remarkable for becoming the great-grandam of Dundee.

Exhibitions of foals with their dams at local Agricultural shows afford encouragement for breeding, and also the first and best means of bringing good stallions into early favorable notice.

There are objections to awarding prizes to gelding colts at various ages, either as hunters, nags, or carriage horses: in the first place, the breeder has encouragement enough in the probable price he will realize for a good colt; but a second and more positive objection is, that good colts are so pampered by feeding, and by being kept up in the stable, that they seldom turn out good for much afterwards; and here, again, the open system of giving prizes has led to the colt being taken from place to place; whilst a wise farmer with a really good one would not enter into competition of fat against form, a pampered horse against a well-kept and level-formed one, gradually growing into worth.

Whenever prizes are given for horses, the judges should agree to take into account the use for which that animal is required; and when made as fat as a Christmas ox, horses should be disqualified from competition as much as if they were pronounced unsound by a veterinary surgeon.

The scarcity of good blood-stallions, available for farmers, at reasonable charges, is proverbial; and yet good horses in no small numbers are produced annually: how these can be obtained as stallions seems to be the question, subordinate only to that of a right understanding of the extent to which they should be employed, and of how to select the good and avoid the bad.

On the rules and regulations of the Jockey Club, from time to time in force, will depend the extent to which good blood-stallions can be obtained, since the temporary failure of our supply is in great measure referable to running our horses at two years old. I distinctly use the word temporary, because I do not believe that any radical or general deterioration has taken place. If two-years old engagements were carried over to the third year, and the more real tests of power and lasting qualities left to be decided at four, the character of the blood-horse would at once greatly improve, and more would be available for stallions without necessarily more being bred. By such reform the forcing of colts would be checked; indeed, it would be incompatible with success, since protracted accumulation of weight would prove an incumbrance. Under a less hurried management, young stock would acquire as much good form as under the present system before being disposed of, besides the larger proportion of them which would be developed into useful horses, of which many are now destroyed before they have had a chance of showing what is in them.

Modern steeple chasing has drawn heavily on the supply of blood-horses, adapted for country stallions; that sport, which formerly was intended to be a test for good riders across country, and also of the clever hunter, has to a great extent been the means of calling out the indifferent race-horse to beat the horse really fit to be ridden to hounds. Many good powerful blood-horses have consequently been converted into geldings, which, as stallions, might have begun in the lower ranks and reached the highest.

The next and most considerable draught from racing stock is that carried off by exportation; this affects our means of obtaining stallions to get hunters, because the better class of horses are selected —those that have run, have stood their work, and are of good size, and sound. Amongst these horses which annually leave the country, are some equal to the best of those left behind. It may be excusable to point to some inconveniences (though the remedy is not so readily seen); because until the influences in operation are shown, remedies cannot be instituted. Blood-horses fit for country stallions are from the above causes much higher priced now than formerly, hence the scarcity of them amongst country stallion keepers. Some of the best blood-stallions in England formerly travelled in Yorkshire, serving country mares at two guineas each, and the owners made a good business by the number of subscriptions obtained; an attempt should be made to open up this channel again. What are called tried stallions are not wanted for this purpose; there are always young blood-horses in various localities, advertised to serve mares at ten guineas each, which do not pay their way; yet these, if properly appreciated in a breeding district, would get plenty of mares. Horses so employed have full as much chance to obtain some blood-mares as if they were kept at more important centres, where those of established repute stay. Brutandorf was serving mares at two guineas each, in the East Riding, when one of his sons, "Physician," was the first young stallion of his day, and another, Hetman Platoff, one of the best horses in training. The owner of Brutandorf did his business well, over a succession of seasons, in the same district; and when the horse was about twenty years old, he was sold to go to Russia, for nearly as many hundreds of pounds.

The wintering of mares and foals calls for little special notice in studs which are well provided with shelter, and paddocks for exercise. Farmers, however, can only adopt such measures as are essential or least inconvenient; and although individually they may have only two or three mares, still on them we are dependent for the greater part of our general supply. In their case the farmyard is commonly made the receptacle for stock indiscriminately, when the field affords neither food nor shelter. There is a commonly prevailing notion that wet about horses' feet and legs is either good or not injurious. Nothing can be further from the truth. Without discussing the relative value of open and covered farmyards, I may state that a wet farmyard is most injurious to horses. A small home-field, with a dry soil, is of the greatest use to turn the young horse stock into daily. Shedding can be made temporarily in fields distant from home by means of upright posts, across which smaller timber or rough materials may be placed, to be covered with furze, reeds, haulm, and such like material, and finished off with thatch. Such a shed for mares and foals or young growing colts will be as comfortable and as conducive to their health as the most elaborate building. Care must, however, be taken that the site is dry and free from all accumulations of wet, nor should these animals be allowed to stand upon an accumulation of dung, but their sheds should be as clean and dry as a well-kept stable. Those rules are not less applicable to permanent buildings; firm, clean stone bottoms are the best surfaces for horses to stand on; these should be thinly covered over with clean straw, which should be changed and the floor swept daily.

Breeders of hunters require to be, as they mostly are, good judges of horses generally, that each animal may be assigned to his proper use. When a colt is growing large and coarse, more like a coach-horse than a hunter, it is well that this should be seen in time, before extra expense is incurred, when perhaps the proper time for sale would be passed over; though good horses often run in families, there is nevertheless frequently great diversity, even in horses that are full brothers.

Hunters of the greatest power, and the best performers under heavy weights are usually about 16 hands high; and some geldings exceeding that height are very well-formed animals, and have good action. Most experienced riders, however, who are in possession of a very good large horse, will be able to tell of one that could carry them quite as well which measured a hand less: my own experience is against high horses; hunters of from 15 to 16 hands high may be equally good for different weights from 11 stone upwards.

Some of the questions which most perplex men in trying to understand the relative merits of horses from their sizes, shapes, and general external appearance, could be reduced to more simple rules, if action were better understood than it has been. Excellent judges of both form and action are to be found who yet, from want of some fundamental rules, are unable to connect the one with the other. Hence the fine form of a horse is not appreciated until after he has performed some feat; and, since the value of the horse turns principally on his locomotive power, the art of breeding and rearing hinges on a right appreciation of action, which is the representation and offspring of form.

When horses like Little Wonder and Daniel O'Rourke, that were sensibly under 15 hands high, are seen to outrun horses of 16 hands for the Derby, it is generally thought that the little horse has gained over the larger, through his quicker movements: that more strides must be taken in the one case than the other; or else that the lower horse keeps up the pace the longest, as is really the case, the larger horse being the weaker. But as regards the length of stride, the notion of the little horse having the shorter is very probably wrong; and when he has beaten the larger animal, it is generally by his length of stride; and the same construction which gives that faculty, confers the power to keep it up.

The eye is the best guide to the forms of the horse. Like the sculptor and painter, we cannot proceed far by measurement; although, like the artists, we can run our rule over one or two points, and then take in the details with the eye.

When making a few remarks on what is understood as good shape in horses of different classes, I will not so much repeat accepted rules as notice a few exceptions to them.

The head of every horse is an important point to be observed and studied. Mechanically considered, the head, by its form and position in relation to the neck and trunk, regulates the action and powers of the horse. Functionally, as the seat of the senses, the head indicates the general character of the horse; and this is the more important consideration.

Good heads I consider may be found in two forms; firstly, we have the Arab type of head, with its broad forehead, tapering muzzle, capacious nasal cavities, small ears, and large free space for the breathing apparatus to play between the upper vertebræ of the neck, and the broad expanse of the lower jaw. Everybody agrees in considering such a head as most beautiful when it is in keeping with the rest of the horse. This character of head, transmitted down a line of our blood-horses, pervades the breed, and is exhibited to a great extent in our mixed breeds. Nothing tends to stamp the character of cross-bred horses so much as this head, taken in connection with form. It is by no means my object to disparage this caste of head, which is characteristic of the finest Asiatic horses, but simply to remark that the head which becomes one horse or class is not the best for all.

The Barbs generally present a different type; in these we find the horse larger, his hind quarters somewhat drooping (not like the vulgarly-bred horse, but resembling many stout racers), the chest deep, with large fore-quarters and loin; the profile is longer and more flattened, the ear and eye very beautiful, all giving a placid appearance whilst the head is fully as easily placed in relation to the neck and trunk as that of the Arab just noticed; moreover, the nasal passages are fully as capacious in this class of oriental horse as in the other.

The Barbs formed in all probability the parent stock of fine horses extending over the south of Europe, as their characteristic qualities have always been exhibited in the Andalusian horse, the Calabrian, the choice old breeds of Rome, and those of the island of Sardinia; and their form of head is characteristic of some of the English lines of blood-stock to the present day. When the broad square head is found in common breeds or in the heavier class of horse, it looks dull, as is seen in those of Central Europe, including those of Switzerland and France.

Artists have fallen into the way of always giving the same head to all forms of horse; and the Paris prints always show the uplifted head, with expanded nostril, and out-stretched tail. But our colossal figures of great horses with these square heads are quite out of keeping. That I may not be supposed to admire the large bony head of the horse of Flanders or Normandy, or of some of the English horses, I will point to Voltigeur as the representative of the fine type I approve of.

The point to be looked to in the head of a horse is its connection with the neck so as to admit of its being brought into a graceful position, when the horse is easily broken, moves gracefully, and breathes freely. If a cross-bred horse combines a large square head with a defective connection in relation to neck and trunk, he cannot bring his forehand into a good posture; and if this be attempted he breathes with difficulty, hence many roarers are found of this form.

Let us, then, improve heads by careful breeding; but not try to obtain on one horse the head which would have better become another.

Whether looking at stallions, mares, or their produce, breeders will be more likely to arrive at a correct appreciation of their worth if they take the whole animal in view at a glance, when, if nothing offend the critical eye, it is most likely that more strict and patient examination into details will confirm the first impression. Men, on the other hand, who are always talking of points, and criticising in detail without knowing what relation one part bears to another in producing such effects as constitute good action, are seldom right by chance.

The choice of a stallion with the idea that something in his shape may correct a defect in the mare is seldom found good in practice; that a horse has good hocks whilst all the rest is indifferent, cannot justify his selection; I have never seen good derived from these compromises; sire and dam should be good all over.

Two measurements may be taken of a horse, which will be found useful and afford instruction, after which the rest may be left to the eye and the touch. Every symmetrically formed horse in good and normal condition will be found to measure about one-fifth more in girth, viz.: round the circumstance of the chest, than he measures in height; he should be of the same height, when standing on level ground, over the withers and rump.

By this rule a perfectly formed stallion of 16 hands in height will girth 80 inches, while the good Clydesdale of 16 hands 3 inches will fully sustain that proportion; and horses of lower standard show no noticeable difference where we find perfection in form.

When the above proportion subsists, the form of the horse will generally be good. Such form ensures a good loin, and, almost as certainly, the well-placing of the shoulder and the good proportion of the limbs, the form and character of which must be scrutinized to the ground: light, powerful, and easy movements result from proportionate construction.

The paces of the horse, the walk, trot, and gallop are all brought into use in the hunter and hack, as they are also constantly exercised in turn by the animal when free. Of the two subordinate and more artificial paces, the amble is seldom seen in England, nor does the English horse take to it easily; but the canter is a common requisite, and is a distinct movement; though it has been regarded as a slow gallop, to which, however, it has no real resemblance: the so-called canter in the trainer's language, is a gallop, and no canter at all.

The horse's balance in his gallop is as perfect as when he is standing or walking; he is so distributing his power, and the feet moving on the ground are one by one raised, and in the same way and succession implanted. Two feet of the horse are always on the ground in varied positions; whilst of the other two, one is disengaged in the air and the other in the act of alighting or rising.

But the horse, the observer will say, gallops by strokes seemingly, using a renewal of efforts, his power is exerted in diagonal lines, thus the action of the near fore and off hind leg moves in close sequence, off fore and near hind following. The sequence of action between each fore foot and its diagonal hind on the ground is so blended, as to make the exertion of one continuous leverage. However we may regard his action, the horse's equilibrium is perfect; the two lateral limbs move in sequence, so that the fore is always carried forward before the hind has passed the centre of gravity. I have hitherto observed the movements, in diagonal and parallel lines; the fore limbs, in each direction, preceding the hind, with the exception of the first move in the gallop and canter, required as a preparatory and balancing move, not amounting to a full stride.

I cannot admit that either the horse in galloping or any other quadruped flies through the air by means of a succession of bounds: all jumpers are slow movers, and the horse loses time by every jump he takes; the faculty of leaping is reserved for a particular purpose, and not employed as a means of fast progression—a little serpent will go twice across a broad road on its belly before a frog will get once over it by jumps.

If by any device a steam-ship could be so constructed that its paddles were made to strike the ocean waves as the horse's feet are implanted on the ground, with what speed, steadiness, and safety would it advance! If we watch a race where the upper part of the horses and riders are alone in sight, because some obstacle such as a hedge or wall hides the movement of the horse's legs, we shall see directly that the horse does not jump or oscillate, but moves evenly, as a bird flies, or rather as the masts of a steam-ship, when the jerking movement of the machinery is in like manner out of sight. Moreover, the distance at which each foot is implanted from where it was taken up, is no way dependent on mere length of limb, but represents the product of all the motive powers exerted; the velocity at which the body is moving through the air determines the distance of stride.

If the physiology of progression in the horse can be made plain, such knowledge will, by leading to a better appreciation of symmetry, be of the first importance in practice. It will be recognized from the tenor of this essay that height and long legs do not necessarily give long stride; and we may come to understand how it was that Daniel O'Rourke and Little Wonder, when under 15 hands high, beat for the Derby in their respective years good competitors which were a hand higher than themselves. We shall further see how it is that a little animal like the fox is able to run for two hours before animals similarly constituted and much larger. The same law is in operation in one case as in the other.

I will conclude with a few remarks about the feet of young horses of different ages before being put to work. If two pieces of advice which I have given be carried out, the feet will not require much art; if the stock can have plenty of space, the friction caused by exercise will keep the hoof in proper form, and the inner structure will by the same influence be duly developed. Besides this, if horses when brought under cover, stand on a dry hard bottom, the feet will acquire form and strength. Periodical visitations, if to wash and clean the feet, should by all means be adopted; though, if the frogs are free from thrushes, there is no necessity for operating on the feet. Paring the feet I do not think advisable. Once or twice in the winter if the colts cannot get room out of doors, a blunt old rasp may be taken to equalize the plantar surface of the feet, and a little lowering of the outside may be necessary, especially with narrow chested colts. The greater wearing down of the inside is apt to twist the foot and pastern, and even tends to turn the elbow in. Whenever mares or foals are deranged in health, a veterinary surgeon should be called in early, as nothing prescribed by anticipation is likely to meet the requirement.

ON THE NATURE AND COMPOSITION OF FOOD.

BY LYON PLAYFAIR, C. B., LL.D.

[From "Good Words," an English Magazine.]

The comparison of the body of an animal with a common steam engine, if not perfect in a scientific point of view, has at least the merit of enabling us to study with ease certain common requirements of both.

Before a steam engine can do its work it must be supplied with coal, which is merely changed vegetable matter, still readily combustible. The coal burns when it receives a proper supply of air, and the heat produced by the union of the two is passed over to water, so that it may be converted into mechanical force. During the burning of the coal, the water receives a steady boiling heat of 212° F., and the furnace evolves gases which consist of carbonic acid, water and vitiated air; these are finally thrown out of the chimney, while nothing of the original fuel remains behind except the uncombustible ashes in the grate.

Up to this point the animal body has a strange resemblance to the steam engine. The three requisites for the animal are,—food, that is recent vegetable or animal matter; air, which is to burn this in the body and keep up a steady animal heat of 98°; and water, necessary for the working of the complex animal machine. The food, like the fuel of the steam engine, is burned in the body, and in the same way, except that the rate of combustion is slow in the latter and quick in the former; identical gases—viz., carbonic acid, watery vapor, and vitiated air—are discharged from the windpipe as they are from the chimney of the furnace; while nothing of the original food remains in the body, after the lapse of a certain time, except unconsumed substances, like the ashes of the furnace, rejected from the system as effete matter. At this point, however, our comparison is not perfect, for part of the food is used to repair the waste which the body continually suffers, while the engine is repaired with a material not found in the fuel.

Let us take up the comparison again, and apply it in another direction. The force of the engine primarily arises in the sun that shone on the world in past ages and stored up its power in the plants which then grew and are now preserved to us as coal. The fuel merely gives out this original power in burning, and the heat being converted into simple motive force by alternate push and pull of the piston, acting through levers, joints and bands, enables mechanical work of infinite variety to be performed. The force in the animal is derived also primarily from the sun, which, illuminating the world now as it did in olden times, causes vegetation to flourish and stores up force in the food to be applied in the working of the animal machine. The combustion of the food in the body produces a motive force of simple alternate relaxation and contraction of the muscles, which, working through levers, joints and tendons, enables the animal to apply the force in an endless variety of ways. A few words more will complete the comparison for our present purpose. It is easy to express by calculation the amount of mechanical work which a machine can or does produce, and it is equally easy to show what labor an animal with a given quantity of food might perform; but it is beyond human ken to express by figures the intellect of the engineer who is required to guide the engine, and it is only permitted to us to wonder reverently at the vital intelligence which directs the working of the animal body and regulates all its voluntary and involuntary movements. Let us not confound the known with the unknown.

It would be considered a folly for any man to undertake the direction and application of an engine, with the structure and working of which he is entirely ignorant. The body of a man is a far more complex and wonderful machine than any steam engine, and it is the duty of each man to preserve it in the best working order and to apply it to the best purposes. But our systems of education do not include any provision for his acquaintance with this machine, so that it is not surprising that it frequently gets out of order. The science which professes to study the workings of the animal body is termed physiology, and, though still in its infancy, has already large proportions. Our present purpose is merely to take from its book of knowledge a single leaf, on which Liebig and other eminent chemists have written, and to explain what they have told us in regard to food.

Here we must again draw attention to the point in which our comparison of the steam engine with the animal body failed. In the case of the former the material of which the engine is constructed is entirely different from the fuel supplied to it; in the case of the animal the very structure itself is furnished by the food; and as the body is constantly wasting so must it be continually supplied. We must therefore expect to find in food two classes of ingredients:—(1) those required to build up the fabric of the body; (2) those necessary for the support of animal heat. Our attention will be in the first place confined to what may be called the structural part of food.

Beccaria in 1742 asked, "Is it not true that we are composed of the same substances which serve as our nourishment"; and George Herbert expresses the same idea when he writes:

> "Herbs gladly heal our flesh because that they
> Find their acquaintance there."

In all kinds of vegetable food capable of affording nutrition there are certain substances which are not only like, but essentially the same in composition as, the principles of which the animal body consists. The albumen of the white of egg is equally found in the cabbage; the fibrin which forms an important part of blood and the chief part of flesh, abounds in wheaten flour and in the cauliflower. The casein or cheese which is obtained from milk is present still more abundantly in peas and beans, from which the Chinese in reality extract it and make cheese for sale. So that if we were to take any of these principles from vegetables, or from the flesh or blood of animals, and place them in the hands of the most skilful chemical analyst, he would not only be unable to distinguish those of vegetable from those of animal origin, but he would find it difficult, by composition merely, to separate one principle from another, all having the same ingredients in almost the same proportions. They contain, besides sulphur, four organic elements, viz.: Carbon, Hydrogen, Oxygen, and Nitrogen, in such proportion that the following composition in 100 parts would fairly represent them all, except perhaps Fibrin:—

Carbon,	53.8
Hydrogen,	7.0
Nitrogen,	15.7
Sulphur,	1.2
Oxygen,	22.3
	100.0

Better numbers than these could scarcely be given for the organic portion of flesh or of blood free from fat.

With these facts before us, the nutrition of an animal is easily understood. Animals find the materials for their structure already elaborated by vegetables, and have nothing to do but to give them a place and form in their organism. As the builder finds the bricks supplied to his hand and only requires to fashion them in order, so the animal has nothing whatever to do with the formation of structural materials, but has only to arrange them so as to carry out the design of the great Architect who created his body. No one finds it difficult to understand how a carnivorous beast receives the materials for its frame. It eats the flesh, blood, and bone of its prey, and merely re-arranges them in its own system ; in a chemical sense it eats itself. A suckling child is also carnivorous ; it is a young cannibal, feeding upon its mother and applying part of her body to its own uses. Equally simple is the nutrition of the vegetable feeder, who finds all the materials of its structure ready prepared in plants, and has nothing to do with their elaboration, but only with their application.

As flesh-feeders live upon vegetable feeders, the primary source of all animal frames resides in plants which form the only laboratory for the preparation of the structural materials of animals. All this has been arranged with infinite foresight by the Creator ; for animals, in the execution of their higher functions, such as locomotion, volition, mechanical and mental work, could not expend their vital agencies in elaborating materials for their bodies out of unlike matter. Plants execute this work for them so completely that animals have nothing to do but to build the ready-formed materials into their frame. A convenient name for this class of structural materials is that of *flesh-formers*, and by that term we include them all, whether they be of vegetable or animal origin.

Let us leave the class of structural food for a time, and consider the fuel which gives the necessary heat to the body. The temperature of a man is from 98° to 99° Fahrenheit, or about 40° higher than the air is in this country. The body being therefore continually robbed of heat by a cold atmosphere, must have an internal source of supply. The fuel which burns in the furnace of the body consists mainly of bodies from which the element nitrogen is absent. The order in which they form fuel of the best quality is the following : (1) Fat, (2) Starch, (3) Cane Sugar, (4) Grape and Milk

Sugar. Their value varies considerably, for 40 parts of fat will give out as much heat as 97 parts of starch or 100 parts of sugar, or 310 parts of flesh, when that structural food is used for such a wasteful purpose as the supply of heat to the skin. In the ordinary combustion of a fire, the oxygen of the air unites with the carbon and hydrogen of the fuel, forming carbonic acid gas and water. The air taken in by the lungs furnishes oxygen to the blood. About 7 cwt. of this gas are annually inhaled by the lungs of an adult man, and nearly one-fifth enters into combustion in the body with the food. Clearly it must pass away again in some form, for the body of a healthy adult is the same in weight at the end as at the beginning of the year. It is easily to calculate how much heat a daily supply of oxygen would afford; for the combustion in the body, though slow, gives out just as much heat as if the food were burned in a fire-place. After making full allowance for the heat expended in evaporating the usual quantity of water by perspiration, there is as much left as would raise 143 lbs. of water from 32°, the freezing point, to 212°, the boiling point. As water requires more heat to raise it through this range than the solids of the body, the amount of heat daily generated by the combustion of food is amply sufficient to keep the body of a man of 150 lbs. in weight at the proper temperature.

As the quantity of coal consumed in a common fire-place changes with the conditions under which the combustion proceeds, so also does the quantity of food vary with the altering conditions of the body. When a fire is stirred, combustion is quickened, because oxygen from the air enters more freely among the particles of the fuel and unites with its ingredients. When the body of a man is stirred into activity by any cause, such as by walking, by labor, by speaking, the lungs act more quickly, additional oxygen enters the body, and its internal heat is augmented. The rhythm of the respiration regulates the quantity of air taken into the lungs and of the oxygen absorbed. About six-sevenths of the oxygen absorbed by the blood are used to burn the charcoal or carbon in the food, the other seventh part burning the free hydrogen of the fats or wasting the tissues. An adult man in this country, while at rest, burns in his body rather more than 7 oz. of carbon daily; gentle exercise increases the amount to 8¾ oz., and hard labor augments it to 11¾ oz.

We may the more readily understand the varying quantities of food demanded to preserve the constant temperature of the body if we suppose, by way of illustration, that the task were assigned to us of keeping up the heat in the cabin of a ship to a uniform temperature of 98°. Our ship may be supposed resting before Calcutta, where we have seen the temperature of a cabin above 90°. In this case, in the discharge of our assigned duty, we would require to burn very little coal to raise the temperature of the cabin an additional number of 8°. The ship sails to England and arrives in winter when a frost prevails; coal must now be heaped up in the stove to prevent the heat of the cabin from sinking below the prescribed temperature. The ship is next ordered on a whaling expedition to the arctic seas, where, on its arrival, the intense cold compels us to keep up an incessant fire burning with great briskness, if our fixed temperature is to be maintained. The body of a man is a chamber always to be kept at the same heat under the most varying circumstances. Its temperature when in health is the same, whether it basks in the sun at Naples, or is exposed to the rigor of a winter at Melville Island in the polar seas. This constancy of heat is preserved by burning fuel in the body in exact proportion to the demand for it. If clothes are heaped on the body, it is more slowly chilled and requires less fuel, so that our garments economize food and are an actual substitute for it. During famines it is not unusual to find families lying in bed covered with clothes, so as to diminish the cravings of hunger, the warmth being an equivalent for one kind of food, and the rest diminishing the activity of the lungs, or in other words, the supply of oxygen to the system. But although this answers as a temporary expedient, the internal fire soon goes out unless fuel be supplied to it. Sir John Franklin in his travels writes:—"During the whole of our march we experienced that no quantity of clothing would keep us warm while we fasted, but on those occasions on which we were able to go to bed with a full stomach we passed the night in a comfortable manner." The altered rhythm of respiration and the consequently changing appetite regulates for us, with more precision than the best adjusted damper in a fire-place, the quantity of fuel required by the body. With that wonderful wisdom which is displayed in all the works of God, we find even the nature of food in different countries suited to the exigencies of climates. The fruits and rice of hot countries form fuel rich enough for the tropical regions, while the fat and blubber of fish give the requisite highly combustible food to the Esquimaux and other arctic inhabitants. The quantity of food shovelled daily into the mouth of one of these people would be incredible unless so frequently attested. Thus Sir J. Parry weighed the food of an Esquimaux lad, and found him to consume in one day:—

Seahorse flesh, hard frozen,	4 lbs. 4 oz.
" " boiled,	4 " 0 "
Bread,	1 " 12 "
Rich gravy soup,	1¼ pint.
Raw spirits,	3 glasses.
Strong grog,	1 tumbler.
Water,	1 gall. and 1 pint.

Sir John Ross assures us that a full-grown Esquimaux will eat daily 20 lbs. of flesh and oil. A Yakut washes down this quantity of flesh with a quart or two of train oil, and will eat in addition, as a sort of dessert, on great occasions, a dozen tallow candles. Capt. Cochrane says, in his pedestrian journey through Siberia, that a good calf, weighing 200 lbs., will serve four or five Yakuts for a single meal; and Admiral Saritcheff assures us that in his travels he knew one Yakut who consumed in twenty-four hours, "the hind quarter of a large ox, 20 lbs. of fat, and a proportionate quantity of melted butter for his drink." The admiral sent for this man, to test his powers on a weighed meal, but unluckily he had just breakfasted; in spite of which, however, he sat down and consumed a second repast of 28 lbs. of thick rice porridge, containing 3 lbs. of butter. Now, although in all these authentic accounts, we must remember that savages, whether in hot or cold countries, have great powers of fasting and gormandizing alternately; still, the chief explanation of the enormous consumption of highly combustible food, is the requirements of the rigorous climate. It does not, as compared with our own food in this country, represent a greater difference of fuel than would be required ty keep the same apartment heated to 60° or 70° in sunny Palermo or in frozen Spitzbergen.

The winter sleep of hybernating animals further illustrates the source of animal heat. In summer they eat more food than is required for the daily waste of the body, and the excess is stowed away as fat. This accumulates around the caul and loins, and pushes up the diaphragm or separating membrane so as to lessen the space in which the lungs play. The fat gathers further round the edges of the heart and lungs, and still more contracts the room for the action of both organs. Just as a man after a heavy dinner, which pushes temporarily the diaphragm against the lungs, or a fattened pig, after a meal, falls asleep because an insufficiency of air enters the system, so the hybernating animal sinks into a more permanent state of repose. The respiration becomes so sluggish that several minutes sometimes elapse between the respiratory acts. As a consequence of diminished combustion, the temperature of the winter sleeper lessens considerably. A similar fall in the heat of the body, though of course to a much less degree, is experienced by the after-dinner sleeper, who, feeling chilled by the lessened oxidation, draws his chair towards the fire before indulging in repose. The bodies of winter sleepers are like lamps slowly burning, the fat being the oil and the lungs the wick. Gradually, as the fat is burned away, the space for the play of the lungs becomes enlarged; more oxygen now enters the system, and the animal resumes its active habits in satisfying the demands for food. Any fat animal might, under favorable circumstances, live upon its own fat for a considerable time. There is a case, recorded in the Linnean Transactions, of a pig which was overwhelmed by a landslip and was excavated alive after 160 days, during which time it had lost 120 lbs. in weight. Its fat had been nearly, but not completely, burned away, otherwise the living lamp would have gone out for want of oil. The fat tails of the Dumba sheep, in the Somali country, described by Captain Speke, diminish in size during an arid season, and compensate the animal for the uncertainties of its pasture.

Having now considered very generally the nature of the structural and of the heat-giving food, we may turn to the mineral matter which exists in animal bodies and in the food fitted for their support. Unfortunately the knowledge on this subject is far from being precise. Certain mineral bodies, such as phosphate of lime, magnesia, soda, and potash, chloride of sodium or common salt, sulphates of the alkaline bases, and oxide of iron, are absolutely essential to nutrition. The function of some of them is too obvious to escape notice, as in the case of bones, in which phosphate of lime forms the chief part, amounting in weight, in a full-grown adult, to about 15 lbs. 12 oz. But with regard to other mineral bodies, their exact mode of action is not so apparent. Thus, common salt is known to be quite essential to nutrition. It was formerly a punishment in Holland to feed great criminals on food free from salt, and they are stated to have been subject to the most loathsome diseases. Cattle, on the extensive prairies of America, can be kept from straying by establishing salt-licks in particular places. And yet the whole amount of salt in the body does not probably exceed 4 oz. Undoubtedly it is essential to the processes of digestion and assimilation, although we cannot explain more than a few of its actions. We know that it aids the absorption of water into the system by the process of diffusion; it supplies the acid which the stomach requires for digestion; it gives soda for the formation of bile and of pancreatic juice, and it helps the solution of albumen. If all the organic elements of nutrition — the flesh-formers and heat-givers — were presented to an animal in abundance, in the absence of these mineral substances, the animal would not only cease to thrive, but all nutrition would be impossible. They enter into every organ as a necessary part of it. Different organs, however, show a selection for particular mineral substances. Thus, the brain loves phosphorus, while the bones affect phosphate of lime; fluor-spar passes chiefly to the teeth, to give hardness to their enamel; silica or flint lodges in the nails and in the hair; phosphates of magnesia and phosphate of potash dwell in the flesh, while phosphate of soda prefers to take up its abode in the blood and cartilages. Our information, however, on the subject is very meagre, and while we recognize the importance of these mineral ingredients of food, chemists do not at present profess to explain their action. Just as the flesh-formers are continually passing away from the system in a partially burned state, so do these mineral substances. They leave the body generally in the same form as they were introduced, but in some cases, as with sulphur and phosphorus, they are removed in the form of products of combustion — sulphuric and phosphoric acids.

Having now taken a general survey of the three classes of ingredients of food — 1, the structural food, or "flesh-formers;" 2, the non-nitrogenous food, or "heat-givers;" 3, the mineral food — it is desirable, before examining the value of the various kinds of food, to consider the method in which they are mixed by nature so as to form a complete wholesome nutriment. There is one kind of food in which the mixture is so complete that it may be safely taken as a general type of what all food should be; we allude to the food with which the mother feeds her infant child, viz.: MILK. The milk of the cow in 100 parts has the following composition:

Water,	87.13
Casein,	4.00
Butter,	3.50
Sugar of Milk,	4.60
Mineral Substances,	0.77
	100.00

We see how carefully nature has provided for the growth of the infant. In the casein there is abundance of structural food for the building up of organs; in the highly combustible fat or butter, and in the less carbonaceous sugars, we have a full supply of heat-givers. For the sake of simplicity we have not expressed in the previous analysis the nature of the mineral substances, but it may suffice if we state that in 100 parts of them there are more than 56 parts of bone earth for the building up of the young skeleton, besides common salt, potash salts, iron, silica, and every mineral ingredient that we find in the body. It may be interesting to inquire, with regard to the typical food, what proportion the structural materials have to the respiratory or heat-giving substances. For this purpose, we must convert both the butter and sugar into a common value, and calculate them as if they were starch, which is the most common heat-giving body in different kinds of food. Estimated in this way, the quantity of heat-givers is three times greater than that of flesh-formers. But the nutrition of the young animal is in many respects different from that of the adult. In the case of the latter it is only necessary to supply the daily waste of the tissues; in the former it is also requisite to furnish materials for the growing body, and also abundant fuel to maintain the higher temperature of the infant. With this difference kept in view, all our efforts in diet appear to aim at imitating the typical food, milk, by adjusting a proper balance between the flesh-formers, heat-givers, and mineral bodies. Thus, with a flesh-forming aliment like beef or mutton, we take a rich heat-giving one like potatoes or rice. To fat bacon, abounding already in heat-givers, we add beans, which compensate for its poverty in flesh-formers. With fowls, poor in fat, we consume ham, rich in this combustible. Our appetites and tastes become the regulators of food, and adjust the relative proportions of its several ingredients; aud until the appetite becomes depraved by indulgence or disease, it is a safe guide in the selection of aliments.

The reader will now be prepared to appreciate the value of tables showing the relative amount of the three great classes of alimentary substances as they are presented by nature in different kinds of food. The chief varieties of food are described in the table on pages 162–3, which indicates the composition of the nutritive portions of food in 100 parts, which, according to the fancy or convenience of the reader, may be taken as 100 grains, 100 ounces, or 100 lbs. The table indicates all the important ingredients of food. To show how this table is to be read, let us take bread as an example, and find out its nutritive value in 100 oz. In the case of bread the table gives the following information in ounces and tenths of ounces :—

100 oz. of bread contain—

Water,	44.8	oz.
Flesh-formers,	8.2	"
Starch,	44.5	"
Fat,	1.0	"
Starch-equivalent of heat-givers,	46.9	"
Ratio of flesh-formers to heat-givers,	1:5.72	"
Mineral matter,	1.5	"
Carbon in flesh-formers,	4.4	"
Carbon in heat-givers,	20.5	"
Total carbon,	24.9	"

In other words we are told that in every 100 oz. of bread consumed by us there are about 8 oz. of matter calculated to repair the waste in the body, 47 oz. of fuel to keep up the heat, 1½ oz. of mineral matter for the bones and for carrying on the processes of digestion and assimilation; while we receive the further information that 20½ oz. of charcoal (carbon) are burned completely in the fuel, and about 4½ oz. go in another direction, regarding which we shall have important information to give hereafter.

It may be useful again to explain what is meant by the term "starch-equivalent" of heat-givers. The latter consist of fat, sugar, starch, and gum; but each of these have, as we have already shown, a different value as fuel, just as coal, and wood, and peat have different heating powers in common fire-places. If, therefore, all kinds of fuel were massed together indiscriminately, a very erroneous idea would be given of the heat-giving character of the food; but by converting them all into one value, viz., that of starch, the comparison of one kind of food with another may readily be made.

Water is a large ingredient in all kinds of food. Perfectly lean flesh contains 75 oz. of water in 100 oz. of meat, but the quantity of water varies much in different foods. Thus flour, oatmeal, and the cereals generally contain about 13 oz. of water in the 100 oz., while turnips, carrots, potatoes, and parsnips have from 75 oz. to 85 oz. of water in 100 oz. of the food as sold.

We now proceed to make some general observations on the different kinds of food in the table, remarking, however, that all such tables give only a general and not a perfectly precise information, because as each beast fitted for the market is more or less fat, so each kind of plant grown varies more or less in its composition. The table is therefore constructed on what may be supposed to be average samples of each kind of food.

It may justly raise a question if it be right to consider all the flesh-formers of equal value, whether they are derived from vegetable or animal aliments. Would, for instance, the 22 oz. of casein in 100 oz. of split peas be equal to the same amount of albumen and fibrin found in 100 oz. of beef? In all probability they would not, for when nature presents us with three materials of like composition—fibrin, albumen, casein—she has no doubt specific functions for them to perform in building up the animal frame. But experience certainly shows us that if we present all these three materials to the body, it can exercise labor and be kept up in strength whether they are derived from animals or from vegetables. Let us take the case of a hunt as an illustration. In a hunt an omnivorous animal, a man, is mounted upon a herbivorous animal, a horse; he is attended by carnivorous dogs, which pursue a vegetable-feeding hare or a flesh-eating fox. In the case of all these animals, a maximum amount of labor is bestowed while the hunt lasts, but the tissues, which by their waste produced the labor, were built up in some cases by animal, in other cases by vegetable food. Undoubtedly the nature of the food has much influence upon the character of animals, and of their ability to exercise consecutive and persevering labor; but this is a question far in advance of that which we are at present discussing.

In animal aliments the heat-giving portions are in the form of fat. No doubt fat forms an indispensable part of all dietaries, for we find it also in vegetables as well as animals. In 100 parts of oatmeal there are six parts of fat, and in maize or Indian corn there are seven parts to the 100. And just as we found the flesh-forming principles in vegetables and in animals to be the same, so do we find the same kinds of fat in both kingdoms of nature. Human fat exists in palm oil; the fat of train oil, as got from the whale, is also found in the root of valerian; the fat of mutton and beef exists in cocoa beans. But the simplicity of nutrition, which characterizes the assimilation of flesh-formers, is not found to prevail in respect to fats. The latter need not pre-exist in food, for animals may make them out of sugar or starch. A cow forms the butter in milk, though none was in the grass on which it fed; a pig will fatten on potatoes, in which no hog's lard is found; a bee can make wax for the comb from flowers in which there is no wax; and a goose fed on wheat forms fat which was not in the food. So fat, although important as a part of a diet, and forming, in fact, one of the most valuable ingredients of heat-givers, is not essential in the same sense that the flesh-formers are. In fat meat the proportion of the latter to the starch-equivalent of heat-givers, is nearly the same as in milk, viz., as 1 to 3. In cheese and in eggs the proportion of the two classes is as 1 to 2.

Going down the nutritious table we come to the leguminous plants, such as peas, beans, and lentils. With the exception of cheap cheese, this class of plants presents us with the most flesh-forming food in the whole table. Lentils ought to form the chief part of the meal sold as *revalenta arabica*, (although much sold under that name is chiefly Glasgow peas meal, costing 2*d*. per lb.,) and has been long known to us as the "red pottage" for which Esau sold his birthright. In this class of highly nutritious food we find the flesh-formers and heat-givers standing in the proportion of 1 to 2½. This proportion is, in fact, too small for healthy nutrition, and we find experience teaching us to augment the proportion of heat-givers to flesh-formers, so we mix potatoes with peas in making pea soup, and we take fat bacon with our beans.

The third group of food in the table comprises the cereals or corn crops, and bread made from flour; all of these contain flesh-formers in marked quantity, though less in amount than in the two preceding groups. Rice stands lowest in this group, having 6 parts in the 100 of flesh-formers, while oatmeal stands highest, having 16 parts. All of them abound in starch, and contain fat in quantity varying from 1 to 7 per cent. Omitting rice, in which the proportion of flesh-formers to heat-givers is as 1 to 12, the other members of the group range between 1 to 5 and 1 to 8. Bread, which can support life by itself, though not with vigor and activity, has its flesh-formers and heat-givers in the ratio of 1 of the first to 5¾ of the latter.

TABLE OF COMPOSITION OF FOOD IN 100 PARTS.

Name.	Water.	Flesh Formers.	Heat Givers.	Starch-equivalent of Heat Givers.	Ratio of Flesh Formers to Starch equivalent.	Mineral Matter.	Carbon in Flesh Formers.	Carbon in Heat Givers.	Total Carbon.
Lean Butcher's Meat, free from bone,	67.0	23.0	Fat, . . . 8.0	19.2	1: 0.83	2.0	12.37	6.16	18.53
Fat ditto, ditto,	63.0	15.0	Fat, . . . 20.0	48.0	1: 3.2	2.0	8.07	15.4	23.47
Mean of Lean and Fat Butcher's Meat, free from bone,	65.0	19.0	Fat, . . . 14.0	33.6	1: 1.77	2.0	10.22	10.78	21.00
Fresh Fish, without bone,	81.3	12.5	Fat, . . . 5.2	12.5	1: 1.0	1.0	6.5	3.8	10.3
Salt Herring,	49.0	20.0	Fat, . . . 12.7	30.45	1: 1.52	18.3	10.76	9.78	20.54
Milk, (new,)	87.2	4.0	Fat, . . . 3.5 Sugar, . . . 4.6	12.5	1: 3.12	0.70	2.152	4.535	6.687
" (skim,)	88.6	4.0	Fat, . . . 2.0 Sugar, . . . 4.6	8.8	1: 2.2	0.77	2.152	3.380	5.532
" (butter,)	89.1	4.0	Fat, . . . 1.5 Sugar, . . . 4.6	7.6	1: 1.87	0.75	2.152	2.995	5.147
Cheese, (cheap kinds,)	40.0	30.0	Fat, . . . 26	62.4	1: 2.08	4.0	16.14	20.02	36.16
Eggs, (yolk and white,)	75.0	12.6	Fat, . . . 11	26.4	1: 2.09	1.4	6.788	8.47	15.26
Peas, (green,)	55.0	7.0	Starch, &c., . 35 Fat, . . . 1	37.4	1: 5.34	2.0	3.766	16.31	20.076
" (dry,)	15.0	22.0	Starch, &c., . 58.5 Fat, . . . 2.0	63.3	1: 2.87	2.5	11.836	27.514	39.35
Beans, (dry,)	12.0	26.0	Starch, &c., . 57.0 Fat, . . . 2.0	61.8	1: 2.37	3.0	13.988	26.85	40.84
Lentils,	12.5	27.0	Starch, &c., . 55.0 Fat, . . . 2.5	61.0	1: 2.26	3.0	14.526	26.34	40.86
Flour,	13.3	14.0	Starch, &c., . 70 Fat, . . . 1.5	73.6	1: 5.26	1.2	7.532	31.08	38.61
Bread,	44.8	8.2	Starch, &c., . 44.5 Fat, . . . 1.0	46.9	1: 5.72	1.5	4.411	20.52	24.93

Biscuit,	13.8	14.2	Starch, &c., . 69.3 Fat, . . . 1.0	71.7	1: 5.05	1.7	7.64	51.539	59.179
Barley, (pearl,)	15.1	8.0	Starch, &c., . 74 Fat, . . . 2	78.8	1: 9.85	0.9	4.304	34.396	38.69
Oatmeal,	13.0	16.0	Starch, &c., . 62 Fat, . . . 6	76.4	1: 4.77	3.0	8.608	32.35	40.95
Maize,	12.0	11.0	Starch, &c., . 68.5 Fat, . . . 7.0	85.3	1: 7.75	1.5	5.918	35.804	41.722
Rice,	13.0	6.5	Starch, &c., . 79.2 Fat, . . . 0.8	81.1	1:12.48	0.5	3.497	35.781	39.278
Potatoes,	75.0	1.4	Starch, &c., . 22.5 Fat, . . . 0.1	22.7	1:16.21	1.0	0.753	10.715	11.468
Parsnips,	85.1	1.4	Starch, . . 10.0 Sugar, . . 2.5	12.4	1: 8.18	1.0	0.753	5.492	6.245
Carrots,	86.5	1.3	Starch, &c., . 6.30 Fat, . . . 0.15 Sugar, . . 5.00	11.3	1: 8.70	0.8	0.7	5.417	6.117
Turnips,	91.1	1.2	Starch, &c., . 3.2 Sugar, . . 3.0	6.1	1: 5.08	1.5	0.645	2.684	3.329
Succulent Vegetables,	85.8	1.3	Starch, &c., . 12.2	12.2	1: 9.4	0.7	0.7	5.417	6.117
Arrowroot,	12.0	1.0	Starch, . . 86.7	86.7	1: 86.7	0.3	0.538	38.49	39.03
Sago,	14.8	1.5	" . . . 83.5	83.5	1: 55.6	0.2	0.807	37.074	37.881
Tapioca,	13.0	2.0	" . . . 84.7	84.7	1: 42.3	0.3	1.076	37.607	38.683
Sugar,	5.0	0.0	Sugar, . . 95	91.5	1: ∞	0.0	0.0	39.99	39.99
Butter,	13.0	1.0	Fat, . . . 86	206	1: 206	0.0	0.538	66.22	66.758
Suet,	13.0	0.0	" . . . 87	208	1: ∞	0.0	0.000	66.99	66.99
Lard,	8.0	2.0	" . . . 90	216	1: 108	0.0	1.076	69.3	70.376

NOTE.—In this Table 10 parts Fat are considered equal to 24 parts of Starch. Under the heading "Starch, &c.," Cellulose and Gum are included. The amount of Carbon is taken as follows:—

Flesh-formers,	53.8 per cent. Carbon.	Sugar of Milk,	40.0 per cent. Carbon.
Starch,	44.44 "	Fat,	77.0 "
Sugar, (Cane,)	42.1 "		

We now come to the group which we ordinarily class in culinary language as "vegetables," including potatoes, carrots, parsnips, turnips, and succulent vegetables. They all contain so much water (from 75 to 85 per cent.), that their nutritious value in 100 parts is low as compared with the preceding group. None of them contain as much as 1½ oz. of flesh-formers in 100 oz. of the vegetable. We now find, in addition to starch and fat, a notable quantity of sugar—in the case of carrots amounting to 5 per cent. Their mineral matter is rich in alkaline salts, which possibly explains their value in scurvy. Potatoes form an eminent heat-giving food, for the proportion between the flesh-formers and heat-givers is as 1 to 16, whilst in the other vegetables in this group the proportion is as 1 to 8. They are therefore all justly considered as accessory food, useful as additions to more nitrogenous foods, but not economical as a source of supply of the latter.

As we descend in the table we come to arrowroot, and similar bodies, such as sago and tapioca, and sugar. These now cease to be considered as, in many respects, entitled to be classed as food. They afford, it is true, one very important ingredient of food—fuel for the support of animal heat—but when of the best quality may be entirely free from flesh-formers, or from mineral material fitted for the supply of the system. They can never be used for nutrition proper, having nothing in them to build up the structure of the body, but they may be highly useful as additions to a diet, by increasing the quantity of heat-givers when these are deficient.

The same remarks apply to such substances as butter, suet, and lard. Like all fats, they may form powerful accessories to nutritious food, but they cannot by themselves nourish the body, having no nitrogen in their composition, or, at all events, only that which comes from their accidental mixture with fleshy matter. They are rich in carbon, which in their dry state amounts to from 77 to 79 per cent., and in their commercial state to from 67 to 70 per cent. They also contain free hydrogen, so that 100 parts of them amount in a starch-equivalent to from 206 to 216 parts.

Some surprise may be experienced that the table contains no account of the stimulating and alcoholic beverages, but it is more convenient to consider them separately. There must be some remarkable use in tea, or it would not at the present time be used by 500 millions of men, or by about one half of the human race. In the United Kingdom, not far from 3 lbs. of tea are annually used by each person—man, woman, and child included; while coffee, although not so much taken by us, requires an annual supply of 600 millions of pounds to satisfy the consumption of the world. There are three stimulating substances—tea, coffee, and Paraguay tea—which have no relationship as regards the plants which furnish them, or as to the countries in which they were indigenous, but all of them are taken as stimulating beverages; a fourth substance, the Guarana tea, is of a like character. Now, when chemists examine these four substances, an alkaloid called *Theine* is found in them all. This alkaloid has very peculiar physiological properties. In small quantities, it appears to arrest the too rapid waste of the tissues. When a person has been laboring, the organs of the body necessarily waste, but the transformation begun is apt to continue when the demand for labor has ceased, and theine has the property of stopping this change. But when taken in too large quantities, as frequently happens in the present evil fashion of taking tea at all hours of the day, it acts on the nervous system, producing irritability of temper and acting unfavorably on the assimilation of food. When this nervous irritability exists, by a change from tea to cocoa (in which an alkaloid closely analogous to theine, called theobromine, exists) equanimity of temper is generally restored. Both tea and coffee contain narcotic and intoxicating oils in small quantity, the aroma and quality much depending upon these oils. Tea and coffee in their solid state contain abundance of casein, the important flesh-forming ingredient of milk; but this does not find its way into the infusion, unless indeed when poor people put soda into the water, which, thus rendered alkaline, may dissolve some of it. It is to the theine that the chief action is due; 100 oz. of tea contain about 3 oz. of theine, and 100 oz. of coffee about 1¾ oz. of the same alkaloid. The quantity of carbon added to a dietary by an infusion of either tea or coffee is too insignificant to be considered. Cocoa abounds in fat—in fact one half, or 50 per cent., consists of a peculiar butter, while there is also about 2 per cent. of its own alkaloid, analogous to but milder in its effects than theine. In the present state of chemistry we cannot follow the transformations of these alkaloids in the body, or explain how they produce their effects.

The alcoholic beverages so commonly used by man act, when taken in small quantities, in a manner similar to tea, but in larger quantities they operate injuriously by exciting the circulation and producing evils of the same kind as an excessive quantity of food. Beer is the cheapest form in which alcohol can be taken; one ounce of alcohol in beer costs twopence; in spirits it costs fourpence; and in cheap wines, eighteen pence. In making beer the grain undergoes in part the same changes that it experiences when taken as food by an animal. The malting of barley converts its starch into gum, then into sugar, which in a subsequent change is transformed by yeast into alcohol and carbonic acid. The substance in the malting which has this transforming effect upon the starch is called *Diastase*; and a similar body, though under a different name, exists in saliva. Accordingly we find Chica beer made in South America by a process less pleasant than malting. Old women chew maize and spit it into jars, when it passes into alcohol, the starch having been changed into sugar by the saliva of the old crones. In the South Sea Islands, Cava beer was made in a like way from the seeds of the long pepper, which was chewed by young women with good teeth, and after being spat into jars was fermented for the king and nobles.

The transformation of all starchy food into sugar is illustrated by these primitive brewers. The animal grinds the food, and by the saliva converts the insoluble starch into soluble sugar; while the changes of such portions as escape the action of this fluid are completed by the pancreatic juice. The stomach has mainly to do with the flesh-formers, and effects their solution. although it commences also the breaking up of the fats. But it is not our present purpose to follow the food through the body, or to show how it is assimilated. We propose, however, to apply our knowledge of the composition of food to an examination of the amount which should be taken by persons under varying circumstances of age, sex, and employment.

We have heretofore shown that there were three great classes of ingredients in food, (1) the nitrogenous ingredients, popularly called "flesh-formers," (2) the non-nitrogenous substances, such as fat and starch, popularly termed "heat-givers," and (3) mineral ingredients. We accepted, as sufficient for scientific as well as for practical purposes, these great generalizations of Liebig. In doing so, it is fair to tell the reader that certain physiologists will consider we are not up to the present state of knowledge, and that we ought to abandon such divisions, "because flesh-formers may not always form flesh, and may sometimes serve as heat-givers, and that both must co-operate in nutrition." But we have already warned the reader that nature requires an admixture of all the classes of aliments in perfect nutrition. This picking to pieces a grand connected classification is not new in the history of the eminent German chemist to whom science owes so much. When he wrote on agriculture, his broad conceptions were misunderstood, and small interpolations were supposed to disconnect or to destroy them, till at length an eminent farmer, the late Mr. Pusey, told us that the only thing which science had done for agriculture was to show "that nitrogen was the food for wheat and phosphorus for turnips." This picking out of two elements from twelve, every one of which was equally necessary to the growth of the plants, was such a singular misapprehension of scientific teaching that the author of the present paper then remonstrated in the following terms: "This is a strange retrograde step in agriculture, when one of its most eminent cultivators, and editor of the Journal of the English Agricultural Society, commends the notion of specifics in the practice of his art. What would be thought of a like dogma in animal physiology? Because the Arab in his desert has little fat and therefore more nitrogenous tissue or flesh; because a Highlander is large-boned and therefore abounds in phosphate of lime; would it be permitted to pick out the two single elements,—nitrogen and phosphorus—from food, and give as a practical dictum, like that announced by Mr. Pusey for agriculture, that nitrogen is the food for an Arab, and phosphorus is the food for a Highlander!" But this illustration, which was taken on account of its absurdity, has now become almost a reality in the writings of some of our distinguished physiologists. Because they find that portions of each of the classes of alimentary ingredients may pass undigested through the system, they tremble to call them of necessity "flesh-formers" or "heat-givers;" because the first class may, and in fact do, under certain circumstances, act in developing heat, and because the heat-givers must co-operate with nitrogenous substances in building up the body, a due proportion of both being essential for the support of life, they abandon the generalization, and look only to the amount of two elements, carbon and nitrogen, neglecting every other element in food, in the absence of one of which full nutrition would be impossible. To deny that the nitrogenous constituents of food are the flesh-formers for such reasons is like saying that bricks are not made of clay, because water and coal are also necessary for their production. This looking to detail and losing the great whole is neither new to common life or science. A man may pass through a city without seeing it on account of the separate houses, or he may miss the forest from the multitude of its trees. To some the fine proportions and adornment of a noble edifice are lost, though the size and material of the individual stones may have been observed. So some physiologists have tried to upset a beautiful generalization by presenting difficulties which have only existence in a limited understanding of it. It is not asserted by chemists that each of the three divisions of food can act in its own way without mutual co-operation. Flesh could not be made by the nitrogenous ingredients of food, unless the heat-givers and mineral ingredients were at the same time aiding it in the work, nor could the two latter be of use in nutrition unless the former were in active co-operation. If they are not well adjusted and taken in proper quantity, some part of them may pass through the system unused. The beauty and truth of the great classification of the ingredients of food is not weakened but strengthened by such facts. We shall adhere, therefore, to the threefold division of food, asserting that the nitrogenous materials are essentially the builders up of the organs of the body, when aided by mineral ingredients, and in co-operation with the non-nitrogenous substances, which have their separate but connected duties to perform in the support of respiration and consequently of heat.

An adult man takes from 30 to 60 ounces of solid food daily, or in the course of the year about seven times the weight of his body, and yet that remains of the same weight at the end of the year as it was at the beginning. We know that part of this food is burned away in the support of respiration, but we have not yet considered in detail what becomes of the nitrogenous portions of the food. The body of a man consists of certain chemical ingredients the weight of which is known to us. Quetelet found by a large series of observations that the mean weight of an adult man of 30 years of age is a little above 140 lbs., or exactly 2245 ounces; if such a man were put into a mortar and mashed up, so that all his organs were destroyed and his bones mixed up in the mass, the chemical constituents of the pounded-up man would be as follows, in ounces and tenths of an ounce. (And here we may remind the reader, who is not accustomed to work with decimals, that the figure after the point always means tenths of an ounce in this paper; and when a *second* figure occurs after the point, it refers to so many hundredths of an ounce.)

Albuminoids or "flesh-formers,"	342.9	oz.
Derivatives from albuminoids, like gelatin,	109.4	"
Fat,	55.2	"
Coloring and extractive matter,	12.5	"
Mineral substances,	205.9	"
Water,	1519.1	"
	2245.0	"

We may run the first two lines together, and say that a man of 30 years of age contains in his body 452 ounces of substances having a like composition to the flesh-formers in his food. There is an old tradition that the body of a man changes completely in seven years. The fact is that it changes, if not completely, at least nearly so, in about 113 days. In other words the body wastes at such a rate, that all its nitrogenous substances would disappear in 113 days if the waste were not supplied by flesh-formers in the food. The bones obviously take a longer time to change, and if we may hazard a guess by the quantity of phosphates excreted, they may not change completely for 15 years. The blood is continually carrying to each organ of the body nutritive substances to repair it, but it is also simultaneously carrying away matters which have served their purpose and which are to be removed from the system. The new materials are built exactly into the place and form of those which are removed, so that the configuration of each organ or tissue remains apparently unaltered, although in fact continually changing. In every organ of an individual, life, in the form of local births, and death, by the destruction of parts, rapidly and incessantly alternate. A portion of matter is endowed with its allotted period of life, and is moulded into a living tissue, while a like portion of matter dies and is absorbed and secreted as its predecessors were before. The probability is that force is never manifested in any organ of the body without a partial destruction of it. A finger cannot be raised without a portion of its muscles being wasted in the effort, absorbed into the blood, and subsequently excreted from the system. The oxygen dissolved in the blood which circulates through the muscle is the immediate cause of the destruction. Blood circulating through a muscle at rest contains about 7½ per cent. of oxygen, but when the muscle is in a state of contraction it is reduced to 1½ per cent.; so that it obviously passes over and necessarily destroys the tissue which is exhibiting activity. Violent muscular effort soon shows this result by exhaustion. Rest now becomes necessary to enable the blood to restore the wasted part and build in living tissue in the place of that which has been removed. There is no reason why we should be afraid to admit that every thought and sensation produces a similar waste of nerve and brain tissue, just as mechanical labor does of muscular tissue. It is impossible to conceive mind manifesting itself to the world through inert and unchanging matter, when we know that animation and the power of change are essential to every living act. As our intellectual work is done through the agency of material organs, these must be altered in the performance of the commands of volition.

We now proceed to consider how much material must be supplied to the body to compensate for the waste which it experiences under different circumstances. We first propose to discuss how much food is requisite for mere subsistence; then to ascertain what quantity suffices for full health; and finally to supplement our information by investigating the amount necessary to support hard and continuous labor.

To treat these subjects properly would require a large volume; in our present limits little more can be expected than generalities. We need not search long to find cases in illustration of the quantity of food which is just barely sufficient to prevent starvation. In the well-known mutiny of the "Bounty," Captain Bligh and twenty-five men were set adrift in boats near the Friendly Islands, and from the close of April to the end of May subsisted on a daily allowance of one-twenty-fifth of a pound of biscuit for each man, with a quarter of a pint of water, and occasionally a teaspoonful or two of rum. While each man must have wasted daily, at a minimum, 2 oz. of albuminous or flesh-forming matter, he received only 280 grains of solid food, containing 39 grains of flesh-formers, or only one-twelfth of the daily loss of the body. Such an instance as this is one of prolonged starvation, not of subsistence. Perhaps no example of an existence prolonged by low diet is more remarkable than that of Franklin and Richardson in their memorable march from the shores of the Northern Ocean to Fort Enterprise. Only one hundred and forty miles had to be accomplished; but the march was undertaken in a climate demanding unstinted food, while the travellers could get little else to eat than *tripe de roche*, a sort of moss. The emaciated travellers found that a mile or two became a heavy day's journey. Yet we all remember that one of the party, Michel, a half-bred Iroquois, remained strong and active, while his companions were dying; the cause being afterwards ascertained to be that he lived upon the flesh of the dead, killing his comrades for a supply of food. With a strength thus preserved, Michel could easily have overcome Richardson and Hepburn in open fight, when the former, with a moral courage rarely surpassed, unsupported as he was by jury or court martial, became at once the judge and the executioner of the wretch who nourished himself by the sacrifice of his fellow-men. We have recalled this anecdote, because it presents a desired contrast, and illustrates our meaning, that prolonged starvation is not subsistence in the sense intended by us. We wish to arrive at a condition of food on which a man might subsist without being able to do active labor, for from such a foundation we might build up the requirements of persons under varying conditions. In prisons we have persons confined in warm houses, and doing but little work, while we have also cases recorded where the allotted food has proved insufficient for their sustenance. Let us quote two instances in point. In Bengal, some time since, the rations of the prisoners were entrusted to a contractor, and, as might have been expected, he gave them in such limited quantity, that the health of the prisoners suffered, and their weight sensibly decreased. Under this system each prisoner received weekly 140 oz. of rice, 24 oz. of dahl (a kind of pea), and 3½ oz. of oil. The *daily* value of this diet is as follows:—

Flesh-formers,	2.05 oz.
Fat,	0.73 "
Starch and Sugar,	17.84 "
Mineral matter,	1.30 "

The total carbon in this diet is 9.05 oz. Here, then, we have an instance of a diet on which men lived, though barely and insufficiently. As, however, these men were Hindoos, let us take another instance from this country. Some years since a medical man, wofully ignorant of the science of dietetics, recommended that the prisons of Dundee, Perth, and Paisley should substitute treacle-water for milk; that is, an aliment containing no flesh-formers at all for one rich in them. The new diet was then as follows in the case of the Dundee prison: Oatmeal, 10 oz.; bread, 6 oz.; meat, 1 oz.; treacle, 1.9 oz.; barley, 1.7 oz.; peas, 2 oz.; vegetables, 2 oz. Under this dietary the prisoners became discontented, although their health did not suffer materially; but Dr. Christison, who drew attention to the case, states that 50 per cent. of them lost in weight an average of 4.3 pounds each. This gives us, then, an excellent instance of a mere subsistence dietary. Its nutritive value is expressed in the following numbers:—

Flesh-formers,	2.87 oz.
Fat,	0.87 "
Starch,	12.94 "
Mineral matter,	0.48 "

The starch equivalent of the heat-givers is 15 oz., the total carbon in the food being 7.58 oz., and the ratio between flesh-formers and heat givers is 1 : 5.2. One more instance will suffice. In the recent valuable inquiry into the food of the laboring classes, made by Dr. E. Smith at the instance of the Medical Officer of Health to the Privy Council, the diet is given of needlewomen in London. Calculating this diet by our tables, we find its nutritive value to be the following:—

Flesh-formers,	1.90 oz.
Fat,	1.04 "
Starch,	8.94 "
Mineral matter,	0.31 "

The total carbon in this diet is 5.8 ounces, while the ratio of the flesh-formers to the starch equivalent, which is 11.36 ounces, is as 1 : 6 nearly. That a diet so low as this should prevail among our poor needlewomen, inferior as it is to the insufficient rations of the Hindoo prisoners when fed on contract, sufficiently accounts for the excessive mortality among them as they pursue their tedious work:—

"In poverty, hunger and dirt,
Sewing at once with a double thread
A shroud as well as a shirt."

Summing up what we fear may have been wearisome numbers to many of our readers, it may be stated generally, that a man is reduced to the verge of starvation when he has only 2 oz. of flesh-formers daily in his food. The variation in fat and starch is less between a sufficient and insufficient diet than in the case of flesh-formers, but when the fat falls to 1 oz. daily and the starch to under 12 oz., the diet must be considered a mere subsistence one, even as regards the heat-givers. This estimate only allows 7.1 oz. of carbon in food, while 8 oz. may be considered a minimum, even in a low ordinary diet. In our poor-law unions it is usual to give a subsistence diet, or one suited to the small amount of labor in the workhouse test, and the Poor-Law Board have for several years discussed the nutritive value of the diets given. This experience is highly valuable, and is mainly due to an intelligent official of the Board, Mr. Harries, who from an early period perceived the importance of regulating the dietaries by chemical instead of by arbitrary considerations. The following numbers express the value of the dietaries of able-bodied paupers, as the mean result for all England and Wales during the year 1863:—

	Men.	Women.
Flesh-formers,	3.19 oz.	2.85 oz.
Heat-givers,	14.41 "	12.76 "
Mineral matter,	0.60 "	0.52 "

We are now prepared to go a step further, and discuss what may be considered a full and satisfying diet for able-bodied men who are engaged in occupations that do not involve excessive mechanical labor. We might take as a class of this kind the large body of soldiers found in each country during peace, and whose support in activity and health ought to be and is one of its most important public concerns. As the result of experience, we do find that there is a singular accordance in the nutritive value of soldiers' diets in different countries, as will be seen by the following figures:

	England.	France.	Prussia.	Austria.
	Oz.	Oz.	Oz.	Oz.
Weight of solid food in ounces,	59.67	48.6	55.0	40.75
Flesh-formers,	4.25	4.40	4.0	4.21
Fat,	3.46	1.43	1.10	1.39
Starch,	15.67	16.39	16.85	15.11
Mineral matter,	0.79	0.70	0.72	0.64
Carbon,	11.90	10.45	10.50	10.38

An inspection of these numbers points out the singular fact that, although the amount of solid food varies considerably in quantity, as it also does in the materials of which it is composed, yet the amount of flesh-formers in each country is remarkably uniform, in all cases reaching or slightly exceeding 4 oz. daily, while the quantity of carbon is usually 10½ oz., although in the case of the English soldiers it is nearly 12 oz. These military diets are only in times of peace, for they are found to be quite insufficient during war. They are in fact hardly sufficient for the recruit during his heavy drills, although the sergeant fattens and thrives under them. We may therefore safely take the nutritive value thus expressed as being sufficient for men who are not exposed to heavy labor. We select one or two instances in which the daily consumption of food has been carefully weighed, from among the middle classes, to show the limit of variations:—

	Flesh-formers.	Starch equival'nt.	Mineral matter.	Carbon.
	Oz.	Oz.	Oz.	Oz.
1. Dr. Dalton; height 5 ft. 7 in.; muscular, athletic; philosopher, . . .	4.59	21.65	0.60	10.45
2. Dr. Hammond; 6 ft. 2 in., 14 stone; physiologist, ...	4.25	17.78	0.58	9.28
3. Physician to Murray's Lunatic Asylum, Perth; age 33, weight 8½ stones; walks daily 3 to 4 miles, . . .	3.47	18.93	0.54	8.91

The numbers derived from the study of these middle class diets, lead us to results very nearly the same as those for soldiers, viz., that for able-bodied men, not engaged in active mechanical labor, there should be in their daily food, 4 oz. of flesh-formers, from 2 to 4 oz. of fat, and from 8 to 12 oz. of starch. Besides these ingredients, a man of this kind should receive daily ¾ oz. of mineral ingredients, 23 oz. of oxygen from the air, and about 80 oz. of water, partly contained in the food, and partly imbibed as drink. This is the only way in which a diet can be considered in the present state of science. The system which still prevails among some medical men, and among some Government officers, of looking only to the total number of ounces of solid food, without reference to its composition, is much more silly than would be the act of a builder who looked only to the total weights of building materials shot into his yard, without examining whether these aggregate weights consisted of water, lime, or bricks. Let us recapitulate the results to which we have arrived: the mere subsistence food of a man, without labor, being 2 oz. flesh-formers, 1 oz. fat, and 10 to 12 oz. starch, we must add for comfortable and healthy nutrition to this diet, 2 oz. more of flesh-formers, and 2 oz. more of fat, besides mineral matter, water, and air. We are now able to go another step in advance and inquire, whether such nutrition is fitted for a fully employed laborer.

All experience teaches us, that when much labor is to be accomplished, a large quantity of food must be consumed. A horse, when put to work, receives corn and beans, both being rich in flesh-formers, in addition to hay. Solders cannot fight on their peace diet. We learnt this by dire experience in the Crimea, when our overwrought and underfed soldiers died by thousands of disease, and not by the bullets or steel of the Russians. Towards the end of the war, the mistake was rectified, and the troops became healthy. Other countries knew the fact, and issued "war rations" as part of their system in feeding troops. These war rations are shown in the table given below:

	Solid food.	Flesh-formers.	Starch equival'nt.	Mineral matter.	Carbon.
	Oz.	Oz.	Oz.	Oz.	Oz.
English soldier (Crimean ration) . .	41.0	4.5	19.0	0.6	10.3
" " (kafir ration) . . .	47.4	5.7	21.1	0.7	11.6
French " (Crimean War) . . .	59.7	6.5	26.8	0.9	14.4
Prussian " (Schleswig War, 1864)	48.0	5.9	22.7	0.8	12.4
Austrian " (War ration) . . .	38.6	5.1	26.2	0.5	14.2
Russian " (Crimean ration) . .	36.6	4.7	16.0	0.6	8.7

If these numbers be compared with the peace rations already given, it will be found that the 4 oz. of flesh-formers in peace increased to from 5 to 6 oz. in war; the heat-givers and carbon being augmented in proportion. Not less than 5½ oz. of structural food ought to be given in war, when toilsome marches, want of sleep, and trench-work task the body heavily in labor. Our sailors in the navy receive 5 oz. of flesh-formers daily, and those of the French navy 5½ oz. In the Crimea our soldiers, with their insufficient diet, were only able to remove 10 cubic yards of earth daily, in the construction of the railway from the port to the camp; while the English "navvies" sent over, removed 20 cubic yards. The latter, however, received 45½ oz. of solid food daily, containing 5¾ oz. of flesh-formers, and above 17 oz. of carbon. Navvies, when laboring on piece-work, frequently eat upwards of 80 oz. of solid food, containing 6¾ oz. of flesh-formers, nearly 4 oz. fat, and 24½ oz. of starch, the carbon being about 15½ oz. In fact, the contractor who engages them knows that thair working power is gauged by their appetite, and the men whose appetites fail, are not unfrequently discharged as unfit for employment. "I send round my clerk," says a contractor, "when the men are getting their dinners, and those who can't eat, he marks with a bit of chalk, and we send them about their business." Right in principle though not humane in practice. When unusual work is required, an unusual supply of food must be given. In the late Schleswig war, the meat was doubled on actual fighting days, and the soldiers then fought on a navvy's allowance of nearly 7 oz. of flesh-formers. In Holland there is, or there was lately, a singular economy in this respect. The Dutch soldier in garrison was fed like a pauper, with 3 oz. of flesh-formers daily, but his war ration brought it up to nearly 4½ oz.; "Dutch courage," or fighting with a full stomach, has thus a physiological explanation.

From what has been already said, it will have been gathered that we are of opinion that 2 oz. of flesh-formers may keep a man alive when at rest; but that 3½ oz. are required to preserve his health with moderate exercise; while 6 oz. are requisite for a hard day's work. The difference between the two last numbers gives us 2½ oz. as the quantity of flesh-formers necessary for hard productive labor, or for exercise such as walking twenty miles daily, over and above the 3½ oz. used for keeping the body in health. In the functions of bodily activity there are four kinds of work which a man has to perform: (1) Vital Work; (2) Heat work; (3) Medhanical work: (4) Mental work. The vital work refers to that proceeding in the body, in the direction of which man is more or less an unconscious agent. The heart beats, the blood circulates, the lungs play, digestion, assimilation, and secretion go on by an inner directive movement independent of the man's will. On these operations a large amount of work is expended. We can calculate it with accuracy in the case of the human heart. This important organ is continually propelling blood with force through the arteries, never ceasing day or night in its labors. If we suppose that the efforts used by it in propelling blood were all concentrated in raising its own weight, then its daily work is represented by the astonishing number that it might raise its own weight about ninety miles high. But the conscious man in which the heart resides can, with a hard day's work, only do as much as is represented by raising the weight of his own body one mile high. It follows from the investigations of Haughton that the heart, weighing only 9 4-5 oz., does one-third of the daily force of the whole frame, which weighs 150 lbs. It labors incessantly, and can tire out 200 times its own weight of the staunchest muscles of the body. The mechanism arranged by Divine power, and placed beyond human control, performs its functions with that wonderful perfection which is observed in all the works of the universe carried on independently of man's will, while the less perfect working of the muscles of the body is no doubt owing to man's inability to use to the best advantage the machine entrusted to the guidance of an imperfectly instructed and erring will. After what has been said, it will not be surprising to find that rather more than one half of the flesh-formers in food are required for the work of life, leaving only about one-half for productive labor. With regard to the "Heat-work," we have little to do at present, for this is chiefly got out of the heat-givers, or substances not containing nitrogen. It is by the transformation of the organic tissues that the vital, mental, and mechanical works are performed, or that the immaterial powers are manifested through matter to the world. The tissues in changing are oxidized, or partially burned, and are excreted in the form of urea. This oxidation may produce heat, and we know that so much heat as would raise the temperature of a pound of water by one degree Fahrenheit is equivalent to the mechanical effect produced by allowing 772 lbs. to fall through the space of one foot. So that the change of tissues may produce mechanical effects in the body instead of heat. This is the essential physical difference between a plant and an animal. Though plants have certain mechanical effects to produce, these are quite subordinate to their general purposes in life, while the conversion of chemical affinity into mechanical effects is the characteristic of animal existence. The potential energy of the food and of the oxygen of the air produces the muscular energy and heat of the animal.

It is not quite certain, but it is, nevertheless, highly probable, that under ordinary circumstances the force expended in the labor of an animal is derived only from the potential energy in the flesh-formers of food, and in the oxygen which transforms them from organic tissues into urea, which is the chief excretive matter of the system. All experience teaches that work can only be got out of an animal by nitrogenous food, and that the amount of available labor is proportional to the quantity of flesh-formers consumed in the food. Let us compare the labor of a horse and of a man in this respect. Seven men can do the work of one horse, according to the usual calculation, or the labor of a man equals one-seventh of that of a horse. A strong horse may be well sustained when at rest with 15 lbs. of hay, and 5 lbs. of oats; but if real work is to be got out of the horse, 16 lbs. of oats are supplied. Calculating from the known composition of hay and oats, the horse receives 27 oz. of flesh-formers when at rest, and 24 oz. additional when at work. If the horse be at work on a railway, it co-operates with an excavator or "navvy," who we have shown eats 6¾ oz. of flesh-formers, of which 3½ oz. are required for his bodily subsistence in health, and 3¼ oz. are available for work. So that the real working food in the case of the horse and of the man is as 3¼ oz. are to 24 oz., or as 1 : 7⅓, which is very nearly the proportion of their working capacities, as ascertained by experience. In the case of the horse, the working power is got out of plants; in the case of the man, it is derived from a mixed animal diet. Yet such a diet is not essential to a man. The miners in Chili, who work like horses, live nearly like them, for two loaves in the morning, boiled beans in the day, and roasted grain at night constitute, according to Darwin, their ordinary food. Even distinguished physiologists doubt whether there is enough potential energy resident in the wasting tissues of the body, to account for the labor of a man. This hesitation is groundless, and can only arise from the fact that few calculations have been made on the subject. We find that the daily waste of tissues secreted as urea by the kidneys, would, after supporting fully all the vital functions of the body, and the limited mental functions of a laborer, enable him to execute such mechanical labor as would raise about one million pounds to the height of one foot. But it has been found that the hardest laborer can, by continuous work, only raise daily 792,000 lbs. to the height of one foot. Though man uses his powers much more economically than a steam engine, it cannot be supposed that he husbands every part of it, and, therefore, an excess of available power was to be looked for. It is, however, in this excess that physiologists have found their stumbling-block. They have perceived that heat, as well as mechanical work, is produced by the waste of flesh, and have, therefore, hesitated to admit a separate class of heat-givers in food. A carnivorous animal is often obliged to depend upon its own tissues as a source of heat during its long-sustained fasts. Even in confinement the hyena is seen moving from side to side of its cage, not in impatience of its imprisonment, but by exercise to transform its tissues, and to allow part of the potential energy of the flesh and oxygen to pass into heat, so that the temperature of its body might be sustained. So a man in a cold day rubs his hands and beats together his arms, or dances with his feet. It is known as the result of experiment that the temperature of the muscles rises during contraction. In tetanus the heat of the body is raised from 98° to 111° on account of the muscular convulsions producing heat. If the transforming tissues do not produce mechanical power to the full extent, they pass the unused force in the form of heat. Darwin tells us that, when in the Pampas, he lived tolerably well, though confined to a meat diet, "but felt that it would only agree with him with hard exercise." Yet he found the Guachos living for months on nothing but beef, "although they eat, I observe, a very large proportion of fat." The Guachos were carnivorous, and like the carnivora required heat developed by exercise, unless they had fat to keep up the heat-work of the body independently of the transformation of tissue. And this explanation accounts for a remark of Sir John Richardson, in his Arctic Travels—"When people have fed for a long time solely upon lean animal food, the desire for fat becomes so insatiable, that they can consume a large quantity of unmixed and even oily fat without nausea." So that we are brought back again by these remarks to the necessity of heat-givers as constituents of food, which we were afraid our readers might lose sight of in the length of our remarks on the production of mechanical effects from the transformation of the organized flesh-formers. To insist again upon the absolute necessity of a proper and judicious admixture of the different ingredients of food, we might quote Moleschott's estimate, that the average complete food for an adult man in good health should contain, in 1000 parts,

Water,	812.07	parts.
Flesh-formers,	37.70	"
Fat,	24.36	"
Starch, sugar, &c.,	117.17	"
Mineral matter,	8.70	"
	1000.00	

The Chinese are the only nation who *manure* their blood by separate mineral ingredients not found in the food, for they carefully incinerate the husk of rice and mix the ashes with the grain.

We have hitherto confined our remarks to adult able-bodied men, and cannot find space to discuss the dietaries of the young and of the aged. The proper amount of nutriment in the food of children is a matter of such passing importance that we feel much inclined to dwell upon it in detail. We must content ourselves however by observing that after having examined and discussed the dietaries of a large number of public schools, containing resident children from 7 to 14 years of age, with an average of about 10 years, we arrived at the conclusion that such school dietaries ought to have the following daily nutritive value:—

Flesh-formers,	3.3 oz.
Fat,	1.6 "
Starch, &c.,	11.4 "
Starch equivalent of heat-givers,	13.8 "
Mineral matter,	0.6 "
Carbon in the food,	8.2 "

The ratio of flesh-formers to heat-givers as expressed by the starch equivalent is in the dietary of school children as 1 : 4.2, while in that of adults it is as 1 : 5. But when we recollect that the bodies of the young have to grow as well as to be sustained, we understand why the proportion of flesh-formers is greater in their case than with the full-grown man. Dr. E. Smith's work, termed "Practical Dietary," affords useful hints on this subject.

The various numerical results presented to the reader may convince his mind without giving him the power of embodying them with practical applications. If this be the case, the reason is to be found in our deficient systems of education. We are not taught as we should be the useful practical lessons of life, or how to apply the teachings of science to our every-day wants. We forget the saying of Milton:—

> "To know
> That which before us lies in daily life
> Is the prime wisdom."

Nor shall we attain the benefits which these discoveries of science are calculated to bestow upon mankind until women are taught domestic economy rationally, not empirically, as a part of their education. Women are the feeders as well as the mothers of men, and if our ladies would but devote a small fraction of the time, which they expend in exercising their fingers by playing scales on the piano, in cultivating a knowledge of the science of life, it would serve them well when they experience their "joy that a man is born into the world;" they would then more seriously fulfil the solemn duties which they have to perform, would largely diminish the amount of infantile mortality, and would give to the world successive generations more fitted to accomplish the purposes of the great God who created them. As part of this rational education an acquaintance both with the science and art of cookery should rank high in importance. Paley says, "As the state of population is governed and limited by the quantity of provisions, perhaps there is no single cause that affects it so powerfully as the *kind* and *quality* of food which chance or usage has introduced into the country." Count Rumford observes, "It seems to me more than probable that the number of inhabitants who may be supported in any country upon its national produce depends as much upon the state of the *art of cookery* as upon that of *agriculture*." There is much more philosophy in the last remark than might be discovered by a superficial consideration of it. If that man be a benefactor to his country, who makes two blades of grass grow where one grew before, so equally is he who, by a judicious selection and cooking of food, enables two men to be fed for the same sum that one was fed before. If the one practically extends the territory of his native land, the other by husbanding its resources enables a larger population to be fed and retained within it, instead of being driven out in a forced emigration by want of the necessaries of life. Let us illustrate this point. In the Irish famine the author of this article was one of the Government Commissioners, and had his attention directed to the necessity of feeding a large population on a very limited supply of money. Such questions as these naturally arose to the mind and were then discussed,—Does the market price of flesh-formers vary much in different kinds of food? Does the price of heat-givers and of carbon show large variations; if they do, what is the method of combining them so as to make a shilling feed six people, when it formerly fed only three? Luckily such considerations as these, which, from their novelty, obtained little attention in the Irish famine, have had an intelligent application during the late cotton famine in Lancashire. Suppose, in illustration of our meaning, that we write down the weights of a few kinds of food which would be necessary, if taken alone, to give a weekly supply of 28 oz. (4 oz. daily) of flesh-formers to an able-bodied man. They are as follows, with their retail market price in Edinburgh on January 2d, 1865:—

			s.	*d.*
147	oz.	Butcher's meat, costing	6	1
700	"	Fresh milk, . "	14	7
93	"	Cheese, . "	3	0
127	"	Split peas, . "	1	2
200	"	Flour, . "	2	1
341	"	Bread, . "	2	8
175	"	Oatmeal, . "	1	4
2000	"	Potatoes, . "	8	11

Let us, in like manner, find out the weight and the cost of giving 140 oz. of the starch equivalent of heat-givers required for a week's nutrition of an adult. The numbers now are:—

			s.	d.
416	oz.	Butcher's meat, costing	17	4
1120	"	Fresh milk, "	23	4
224	"	Cheese, "	7	0
221	"	Split peas, "	1	10
190	"	Flour, "	2	0
298	"	Bread, "	2	3
183	"	Oatmeal, "	1	4
616	"	Potatoes, "	2	9

The great difference between the numbers in these two tables shows that it was never intended that man should live on one kind of food, but that he should make proper mixtures of them, in order that he might supply the deficiency in one ingredient by an abundance of it in another kind of food. Thus potatoes, which are a dearer food than meat for the supply of flesh, are far cheaper as a source of heat to the body, so with this view we associate them in our meals. Cheese gives us cheap flesh but dear fuel, so we take with it bread, which supplies the latter economically. Potatoes lay on flesh at an extravagant rate, so with potato soup we mix peas, which add to its nutritive value and to their economy.

The making of palatable mixtures of various kinds of food forms the art of cookery. It is a maxim as old as Hippocrates, that "whatever pleases the palate nourishes," and it is only when taste becomes depraved by indulgence that the pleasure of eating becomes contemptible. Many dishes of the cook are full of scientific significance. As an illustration, let us ask, why are small square pieces of bread, fried in lard, sent up with vegetable soup? Because starch requires to be mixed with saliva before it is converted into sugar in the act of digestion, and as the soup would pass to the stomach without mastication, fried or hard bread protected from the water by fat, so as to prevent its softening, is taken along with the soup, and compels mastication and a flow of saliva. But if cooks exhibit important scientific applications, they often err from ignorance of science. All the sapid or tasting ingredients of flesh reside in its juices, and not in the solid substance. If the flesh of a deer, an ox, a pig, a cat, or a fox be well squeezed, so as to express their juices, what remains has the same vapid taste for all of them. For this reason roast or stewed meat is generally better flavored than boiled, and the cook protects the juices by pouring melted fat over the joint during its roasting. In boiling meat for soup, cold water should be used at first, so as to extract as much of the nutritive juices as possible, and the heat be raised gradually. But if the meat be wanted in a boiled state for itself, and not for its soup, then it should be plunged at once into boiling water, and kept boiling for a few minutes, so that all the outer albumen may be coagulated, in order to imprison the sapid and nutritive juices; then cold water should be added till the temperature is reduced to 160°, at which it should be kept till the cooking is completed, because that heat is necessary for the coagulation of the coloring matter of the blood. In all cases, no more heat than is sufficient should be employed in cooking. Thus, in making soup, all the fire in the world will not make the water hotter than its boiling temperature, at which point it can be retained by a very moderate expenditure of fuel. Violent ebullition, such as we see cooks often practice, while it does no good, does much harm, not only by wasting coal, but also by carrying off in the steam much of the aromatic and volatile ingredients of the food. Having thus commended the art of cookery as a worthy object of study, we must leave it in order to complete our article with a few general considerations.

The food of different countries has much influence on the character and prosperity of the populations inhabiting them. Cheap and easily procured food is by no means a constant blessing to the nations possessing it. On the contrary, it often produces such a rapid increase of population, that the working classes, in countries tolerably supplied with food, are often in a state of misery and degradation. A lavish abundance of food may produce wealth, but the wealth, in such cases, is very unequally distributed, being enjoyed by a few, while the mass of the population, whose growth it has stimulated, compete with each other for wages, and subsist without enjoying the comforts of civilized life. In such cases we generally find that nations have become lazily satisfied with the bounties which nature has lavishly bestowed upon them, and content themselves with one or two articles of food, instead of exercising productive labor in the supply of a variety. What potatoes were to the Irish before the famine, rice is to the Hindoo, and dates to the Egyptian. But, in all these countries, the same results followed—abject misery among the masses, contrasted with a sprinkling of wealth upon a few. Let us examine the cause of this phenomenon as regards Ireland. An acre planted with potatoes produces about six tons of the tubers, and this quantity is stated to be sufficient for a family of six persons, allowing 6 lbs. daily to each member. An acre of wheat produces 1830 lbs. of the grain, which yields 1700 lbs. of flour. As 25 oz. of flour would barely feed a man daily, a little calculation will show that the acre of wheat could not support more than three men, while the acre of potatoes is alleged to support six. The difference in bulk, as a means of satisfying the appetite, is very considerable, for while the potato feeder got 6 lbs., the wheat-supported man has only 1½ lb. Hence arose the popularity of the potato in Ireland; for, although it is not true that a man could be sustained on 6 lbs. of potatoes daily, he could be with the addition of butter-milk. This economy of subsistence produced a rapid increase of the population, and its natural consequence, depreciation in the rate of wages. But it produced also a reckless and improvident character among the Irish peasantry. The potatoes were grown on the lazy-bed system, which induced no improvement of the land, for it compensated in part for bad drainage. The labor required was only at three periods of the year; during sowing, earthing, and harvesting, while idleness prevailed for the rest of the time, and the habits of the population necessarily became idle and impulsive. We see like results following interrupted labor in Sweden and Norway, where cold interferes with the work; and in Spain and Portugal, where heat frequently arrests it; the result, however, is the same as with the Irish — fickleness and instability of character being the consequence of impulsive interrupted labor. But there is also a physiological, as well as economic reason why the wages of the Irish were so much lowered by their dependence on one staple article of food. Before the famine, the average consumption of an able-bodied laborer, in Ireland, was 9½ lbs. of potatoes for a man, and 7½ lbs. for a woman. But 9½ lbs. of potatoes contain little more than 2 oz. of flesh-formers, which it will be recollected is the mere subsistence allowance, and on which a man could not do a day's work. For a low day's work, 4 oz. are requisite, and this would imply the consumption of 19 lbs. of potatoes, an amount that even an Irishman's stomach could neither have held nor digested. But as a laborer could not do a fair day's work he could not receive a fair day's wages; so it is not wonderful that he was ground down with poverty. The Irish famine was the greatest blessing to Ireland. Although it occasioned much individual suffering, it produced unmixed national good. The confidence in the potato was rudely broken, new kinds of food were introduced to the peasantry, new wants were created, and labor of a more uniform and equal kind was required to gratify these wants. The excess of population necessarily emigrated, and the remainder, having less competition, and being able, by their more nutritious food, to give better and more productive labor, had their wages rapidly increased. It will, indeed, require more than one generation to root out the evils of the past, but the improvement even now is marked in a high degree. No laborer is a better one than the Irishman when properly fed, and he now ranks equal in nutrition to our Scottish agricultural population.

Whilst Ireland was groaning under poverty, partly owing to misrule in past ages, but chiefly due to inferiority in food, Scotland was a thriving country. There were other causes besides food for this difference, but that was a notable and important cause. In

"The halesome parritch, chief o' Scotia's food,"

oatmeal furnished an aliment which enabled productive labor to be freely given, and high wages to be freely paid. But there is still a lamentable absence of variety in our Scotch cookery for the poorer classes, and this is not likely to be remedied till dietetics are more familiarly studied. Scotland has given us for the years 1856–1857 admirable agricultural statistics which open up curious questions. Could such a country produce sufficient flesh-formers to feed its population of 3,062,294 persons, allowing 3 oz. of flesh-formers daily to each? The requirement is no less than 93,560 *tons* annually. But the agricultural plants of Scotland, excluding grass and hay, yield every year 180,178 tons of albumen, fibrin, and casein. Our oats alone grow 80,000 tons of these flesh-formers; but as 180,000 horses come in competition with our population in their appreciation of them, we must allow them 3 lbs. of oats daily, and this reduces, after a further withdrawal of one-tenth for seed, our flesh-formers in oatmeal to 60,800 tons available to man. Let us further bestow all the beans on horses, the turnips on cows, and sacrifice the barley to whiskey, and we have left 87,000 tons of flesh-formers for food. This is not sufficient for our requirements, but then we have not considered the supply of animal food. Our milch cows alone yield us 19,500 tons of flesh-formers in milk to eat with our porridge, and this addition brings us above our wants; so that we are enabled to send some of our oats to our

English friends to feed their horses, and abundance of cattle for that meat-loving nation. These calculations show that Scotland could support a much larger population than she possesses, even though our deer forests retard the growth of beef and mutton.

If we cast a general survey over the whole world, the influence of food on national character is most striking. It may be, and no doubt is, an excess in this direction to say with Mülder, that the steadiness and constitutionalism of England is owing to its beef-steaks and porter, and that the revolutionary character of France depends upon their infinite variety of dishes; but there is some truth even in this extravagant view. In Africa, the flesh-eaters conquer and subdue the miserable tribes who subsist on vegetable products. In the Indian mutiny, the rice-eaters of Bengal were not the men who made our empire totter, but the pulse feeders and the flesh-eaters of the upper provinces. The gallant Ghoorkas, who gave us aid in our distress, were omnivorous like ourselves, and fond as we are of hunting down game and eating it. England would never dare to trust her defence to an army of vegetarians. Prior felt this when he wrote—

"Was ever Tartar fierce or cruel
Upon the strength of water-gruel?
But how restrain his rage or force,
When first he kills, then eats his horse?"

THE BREEDING AND MANAGEMENT OF PIGS.

BY HENRY TANNER, M. R. A. C.

[*A Prize Essay, from the Journal of the Bath and West of England Society of Agriculture, Vol.* 8, 1860.]

NOTE.—The following treatise is one of great value, and is upon a subject not sufficiently understood or appreciated by our farmers. The practical manner in which it is written, and the excellent directions scattered through its pages, will justify a careful perusal.

With comparatively few exceptions English pigs are, at the present time, of mixed descent. Few counties now give a name to a distinct breed, unless it has the prefix "Improved." This, in the case of pigs, implies the introduction of some other blood. The original English pig possessed much the same character wherever it was met with; it was large in size, coarse in quality, with long legs, flat sides, coarse bones, narrow back, strong bristles, and wiry hair. As soon, however, as attention was directed to the improvement of stock, the pig came in for a share, and a more economical animal was sought after. The Essex and Leicester pigs appear to have been the first which took the title "Improved;" and it will be readily admitted that Bakewell and Lord Western did much to justify the designation. The Chinese and Neapolitan crosses were adopted in these instances. In other counties the example which had thus been set them was rapidly followed. The great improvement which has been made in our several breeds of pigs may be traced, directly or indirectly, to the introduction of this foreign blood. The great delicacy of the Chinese pig only allowed of its moderate use in producing the improved Leicester; but the Neapolitan breed was more freely employed in other cases, and from these may be traced the improved Essex breed. Thus, by a greater or less proportion of Chinese or Neapolitan blood being intermixed with our native animals, we have arrived at the position of almost every district having its "improved" breed. This, however, increases in a great degree the difficulty of giving any complete list.

The Large Breeds of Pigs are, with very few exceptions, proportionately coarse; but they are the most prolific, and have the most abundant supplies of milk. Almost every county has its large and coarse specimens; but there are some districts in which size has been more looked after than quality. The Sussex (Rudgwick), Cheshire, and Tamworth pigs are very large and coarse; the Yorkshire pigs are also large, but finer in quality. Additions might be made to this list of breeds; but the above are those which are most distinguished for size. The Berkshires are generally classed amongst the large pigs, although they should rather be placed intermediately between the large and small, for they certainly hold this position on the score of merit. Some of the Berkshires are very large; but the improved breeds vary in size and quality, through every stage, till they are in some cases as fine as almost any breed we have.

The Small Breeds of Pigs almost defy enumeration, for truly they are legion. No sooner is a breed raised to any degree of merit, than the owner or those around him impart to it a new name as a means of localizing it. Thus we get the Windsor breed, Lord Radnor's, Mr. Fisher Hobbs', and many others, which take their names irrespectively of descent. Of the small breeds, the three above named were for a time the most valuable we had; but similar breeds have so spread through the length and breadth of the kingdom, that others are now dividing with them the laurels of merit. It is curious to notice the different breeds of pigs which are entered for exhibition at our agricultural shows. At the Cardiff meeting of the Bath and West of England Society (A. D. 1858,) of the large breeds the white Lancashire was represented by one specimen only; the remainder were all Berkshire. The case, however, was very different with the small breeds, for the entries comprised—

White Improved Yorkshires,
Black Improved Leicesters,
Black Improved Oxfords,
White Chinese,
Black Improved Essex,
Fisher Hobbs' Breeds, &c.

Thus, whilst the Berkshire pig is the general favorite when *size* is desired, there are numerous competitors for favor among the *small* breeds. The list given, however, must not be considered as in any degree representing *all* the small breeds: the names of many others might have been added, for there are few counties (except those in the West of England) which do not claim to have their improved county breeds.

The difference between the large and small breeds of pigs admits of a very clear explanation. The original English pig was large in size, coarse in character, and it acquired some special peculiarities in certain districts, according to its habits of life and its means of gaining support. These variations gradually distinguished the different local breeds. When improved in their character, it was effected by the introduction of foreign blood, and for this purpose the tender and delicate Neapolitan and Chinese pigs were well suited. Between these two extremes—viz., the original large and coarse English hog and the small and delicate Neapolitan and Chinese pigs—all our English breeds may now be ranged, according to their relative size and fineness. To explain this it will be necessary to show the physiological differences which exist between these different descriptions of pigs. In the old English pig we see, in the strong bristles and wiry hair, an indication of a strong constitution capable of withstanding the roughest weather. Its general configuration of body and its powers of locomotion seemed to adapt it for travelling far for food. This was necessarily attended by a free and extensive action of the lungs. Here also the breeding powers were most perfect; the supply of milk was most abundant, and at the same time the active use of the muscular system gave the flesh a considerable degree of firmness. The Neapolitan and Chinese pigs, natives of warmer climates, have not the power of travelling far for their supplies of food. So far from being restless in their character, they are decidedly predisposed to a luxurious mode of life, in which their food is obtained with little trouble. In this absence of active exercise there is no necessity for large lungs, consequently they are not fully developed. Instead, therefore, of the animals expending their food by active habits, they lay it upon their bodies in the form of fat. This is necessarily accompanied with a liability to cold, because of the imperfect and torpid circulation which renders the animal too delicate for exposure in our climate. The intermixture of these distinct classes of pigs has effected a marked improvement. We have animals combining size, hardy constitutions, and a disposition for fattening; as well as other breeds, which, though more delicate in character than those we have just referred to, are nevertheless more suited to our requirements and more hardy than the pure Neapolitan and Chinese. The difference between our several breeds is caused by the proportion of each kind of blood in the animal's parentage. The larger and coarser the pig, the more fully does it prove that its parentage is of the old English blood, while the smaller and finer it is, the greater is the preponderance of Neapolitan or Chinese blood. We may have every intermediate stage of quality between the two extremes; but the same result becomes evident throughout. As the Neapolitan and Chinese blood gains the ascendancy, so it increases the aptitude for fattening and gives early maturity, with a delicacy and smallness of size. On the other hand, in proportion as the old English blood preponderates, so do the progeny take a longer time to fatten; they come to a larger size, and are altogether stronger and coarser. These facts show that, in order to attain the best results, the object to be accomplished must guide us in selecting the most suitable kinds of pigs, and also in their general management. It will, therefore, be desirable to notice each class of produce successively.

Sucking-Pigs.—When the intention is to dispose of the produce, or a part of it, as sucking pigs, the conditions required are—a disposition to *early fattening* and *a fine quality of meat*; but to the attainment of this result as quickly as possible *a liberal supply of milk* is essential. Although these requirements are opposed to each other, still they may be obtained in combination by selecting a boar possessing the former character and a sow distinguished for the latter. In other words, select a well-bred boar of the best possible quality, and let the sow be strong in constitution, large in frame, and a good milker. A large farrow will thus be secured, and the sow will be able to bring them on well. To enable the sow to produce milk with all the freedom of which she is capable, the food must be suitable and abundant: milk, whey, warm wash mixed with bran, oatmeal, peasmeal, or barleymeal; but the latter is sometimes disposed to be heating in its character. A run in a meadow, or some vetches or clover, will tend to keep the blood cool and the milk right. Nothing is more prejudicial to the formation of milk than a feverish condition of the body. If care be taken to keep up a good supply of milk, the young pigs, bred as described, will not fail to be prime when five weeks old.

Porkers of about Three Score Weight.—It is recommended that these should be bred in the same way as the former. Many will be in favor of the improved Essex pig (or some other small breed,) without any cross; but experience is not favorable to such a course. The great disadvantage to be contended against in these well-bred sows is the poor supply of milk, and it is on this account that pigs got by a good boar and nursed by a sow having an abundance of milk will go far before them and obtain such a start that, with judicious feeding, they will produce porkers of the above weight much sooner than when both parents are fine in quality, small in size, and the milk not plentiful. With the above object in view, the young pigs should be kept thriving as rapidly as possible; for the more quickly they can be brought to their weight, the more profitable they will be. As soon as the young pigs are ready for food, they should be supplied with some pea and barley meal, mixed together and made into a thin paste with water. This may be varied with crushed oats and peas as they get better able to eat, and after they are weaned they should be supplied with some milk in their food. Cows' milk is not desirable for sucking pigs; it is then far better to give the milk to the sow. Thus throughout life these pigs should be kept under high-pressure work. The system should be liberally and abundantly supplied with food, and before they lose the sow's milk they should be well accustomed to good and nutritious food, so that no diminution in their previous rate of progress may be allowed to take place.

A farmer has many points to consider before deciding what class of pig to keep. If he has a large dairy he will very likely find it most profitable to consume the waste by sows so bred and kept as to produce small-sized porkers, which may be got ready for market by the aid of corn. It is now an accepted fact that dairy-waste is more profitably consumed when corn is supplied with it. So much is this the case, that *it is usual* in the West of England, when a dairy of cows is underlet, to cultivate for the dairyman some land on which he may grow barley for this purpose. It is probable that for such purposes a large, rather coarse, and good breeding-sow, crossed with *the finest description of boar*, will produce the largest farrows of the most profitable pigs; and that upon those farms where dairies are kept the first two classes of pigs will be produced most economically and of the best quality. Some dairymen adopt another plan: instead of using corn with the waste so as to produce porkers, they keep the young pigs as stores, and sell them when worth about 20*s*. This is considered by many to be making the best of their pigs; but by those who attach due importance to the proper management of dung, a different opinion is entertained. If a farmer grows corn for his pigs and they produce just enough to repay him for the corn eaten, and he allows the manure made to be wasted by negligent management, then it may be admitted he has gained nothing, but lost his labor as a producer of the manure, and in such a case he may find it more advantageous to sell his young pigs as stores; but as soon as he takes proper care of his manure, we may look with confidence to his ultimately realizing an indirect profit from giving his young pigs corn with the waste of the dairy.

Porkers of about Six Score Weight.—In producing this class of meat, the field opens considerably, and many candidates appear. Here we have not only pigs of the kinds recommended for the two former purposes claiming a position of merit, but also all the improved small breeds as well as the Berkshires. While, however, it is only the former class of Berkshire pigs that will equal the others for quality, there is a remarkable difference in the practice to be noticed. A farmer does not keep Berkshires for the sake of producing porkers of this size; but as he keeps them *for other reasons,* and rears more than he wants or finds it desirable to keep for bacon, he produces some porkers to reduce his stock. In the former case the prime object was to produce a small and very delicate class of pork for the city markets; but in this case fitness for market is only an incidental result. What has been said of the Berkshires may be said of other breeds; the kind of pig to be kept is decided on for other reasons, and these porkers are produced as a means of reducing the stock. Another reason for porkers of this weight being seldom produced from pigs specially bred for this purpose is, that when the production of pork is the most influential guide, the smaller size would be produced, as insuring the quickest return, realizing the best price, and allowing of greater profit. Porkers of this class may be, and indeed generally are, produced without any deviation from the regular course of the farm. After leaving the dairy farm, or when the dairy has but little influence, the generally received opinion is that only such a number of store pigs should be kept as will consume the waste of the farm. In a general way this rule may be accepted as true, excepting where a farmer resolves upon consuming a large portion of his spring corn in preference to selling it. This plan may doubtless be adopted with great advantage, provided it is made a systematic part of the business of the farm. Here again no surplus return must be looked for from the corn, because it is changed in form and sold as bacon. Yet if the feeder sees that the increased value of his bacon repays him as much as if he had sold his corn, it is beyond all question that he is a very decided gainer by the alteration, because he has *a very valuable manure* remaining at little or no loss. When this plan is carried out it will be found desirable to give the young pigs additional food, so that they may always be in good condition—even better than that generally described as good store condition; they should be always progressing, for if thus treated they will be found to pay much better when put up to fatten. Under such a system many pigs will be finished off as porkers of the class now under notice; but, as before stated, they will be made porkers of, because other circumstances render it desirable, and not because they have been specially bred for the purpose.

Bacon Hogs of Twelve or Fourteen Score.—This is the best selling bacon produced. It is preferred for the tables of the higher and middle classes, and is consequently worth most money in the market. Of this class of bacon the small breeds produce the larger proportion. The Improved Essex, Middlesex, Bedford, Oxford, York, &c., are here in their zenith, inasmuch as they are the quickest producers of bacon of this weight. The finer bred Berkshires will commence at fourteen score and produce bacon from this weight upwards. The question naturally arises, What are the relative advantages of these breeds for this purpose? In speaking comparatively upon the breeds of pigs, so variable are the data, that it is difficult to give a clear view of the case. Many pigs, classed as of some improved small breed, may be actually coarser than Berkshires, and the same remark is applicable to other breeds. I will, however, endeavor to be as explicit as the facts will allow. The class of pig I will take for comparison, as representing the Berkshire, is one calculated to produce about eighteen or twenty score of bacon; its hair rather strong, but not coarse. Other breeds besides the Berkshire are of the same character, and will be embodied at the same time; but the Berkshire is selected for our purpose because it is more generally known. The advantages which this pig possess are various; it takes a medium position between the coarser and finer pigs. It possesses enough of the former character to insure strength of constitution, and thus fit it for a hard and rough life; without any predisposition to disease, it has a sufficient tendency to quick growth. It is also capable of producing and rearing large farrows; and through life, but especially from twelve to fifteen months old, it has an aptitude for fattening. If pigs have to take their ordinary position on a farm and there pick up their living, often with some degree of industry, it is useless to have them too finely bred. If a person makes up his mind to keep his pigs in yard throughout the year, and there regularly and liberally feed them, it is probable that the finer class of pigs will make a better return in less time; but for ordinary management, when the pig is kept chiefly to consume the waste of the farm until it has made its growth and is ready for fattening, it is necessary to have a more hardy class of pig, and here the superiority of the Berkshire will be manifest. Under a high-pressure system, by which corn is sought to be made into bacon in the shortest possible time, so that bacon may be sold instead of corn, it will be necessary to have a higher bred class of pigs to do the work; under such circumstances, the Berkshires, unless very highly bred, are unsuitable.

Bacon Hogs of Twenty-five Score and Upwards.—These pigs are generally produced from the large Rudgwick, Tamworth, Cheshire, and Yorkshire breeds; but it is doubtful whether, as producers of meat, they are as profitable as those of more moderate weight. If it be granted that the same food would produce the same increase in one of these coarser pigs as in one better adapted for fattening, then it is clear that the return might be made in half the time by two pigs, each producing half the weight. But this admission is totally at variance with all our observations on the production of meat; for it admits of very clear proof that those animals which fatten most rapidly are also the most economical agents for converting food into flesh. As bacon-hogs, we cannot look upon these very large pigs as being desirable; for whereas they certainly do not make so good a return as smaller pigs, they are also longer about it. Considerable value, however, is attached to them as breeding-sows; for, when they are crossed with a boar of medium size, but *very fine quality*, the produce is remarkably good. I know of no sows which can make a more profitable return than these when they are thus used, and believe there is no class of pig which will prove more advantageous than such produce. The progeny participate in all the good qualities of the boar, and all the breeding powers and capability of nourishment of the sow, and thus these qualities are brought to the highest degree of development. I have seen some of the very best of pigs thus bred from sows so ugly and coarse that their owner was almost ashamed of them. Nevertheless, they have characteristics which no other sows possess, for, as compared with others, they bring larger farrows of stronger pigs, and have immense supplies of milk. It may occasion surprise that such sows do not produce young pigs coarse as themselves, but when a *well-bred* boar is used, such is not the case. It would take too long to explain the cause, but of the fact no doubt can be entertained. Pigs thus bred will be most valuable for fattening, but must not be bred from.

This heavy class of bacon is generally preferred in farm-houses fer the use of laborers, and is also much in demand in the mining and manufacturing districts. It is, in fact, the laborer's bacon, and is justly looked upon as the most substantial. This is not surprising when the age is considered; for it is evident that pigs of two or three years old and above must have a stronger muscular development than those which produce bacon more rapidly. It is the same with bacon as with all other kinds of meat. For the sake of economy a quick production is desirable, but for quality of flesh age is required. Let a person compare the mutton of a one year old wether with that of one which is four or five years old, and, provided the latter is well fattened, he will not fail to be struck with the remarkable difference in the quality and flavor. It is equally observable with the hams of these different ages; the old ham is invariably superior, provided the pig has been well finished, so as to get a rich juice dispersed throughout the body. Whilst, therefore, the 12 or 14 score pig, of about as many months old, is preferred for bacon by those who are connoisseurs, the ham of the old pig, from 30 lbs. to 40 lbs. in weight, is considered the best. The Westphalian hams owe their value as much to the age of the pig as to its habits of life. Accustomed as these pigs are to roam over the forests of Germany and subsist upon their natural productions, they acquire a flavor which can never be equalled in England, although it is closely approached by those pigs of Hampshire and Berkshire which are accustomed to have much liberty in the woods, and which have the decided advantage of being better fed before they are killed. An old ham from a pig which has been badly fed is poor and tough, but nothing is more delicious than a ham from an old pig which has been got into good condition.'

Boars for Breeding Purposes.—However desirable it may be for the production of pork and bacon to have a pig half-bred in its character, still we must ever remember that success is entirely dependent upon the qualities of the boar. We may always rely upon securing large and coarse sows—for the less they are improved the more will they assume this character; but the great pivot of success is the production of a superior kind of boar. The hereditary influence of a boar, like that of any other animal, will receive strength by a regular line of descent, and be weakened by crossing. When a breeder has decided upon the class of boar he wishes to produce, he should carefully regard *this hidden point of character*. Two boars may be shown together, and, to the eye, appear of equal value; but their relative breeding powers may be very different. If we breed from a large and coarse sow by a first-rate boar, the produce may probably possess even better characteristics than the sire. For breeding purposes such produce would be almost worthless, notwithstanding that they may appear equally good to the eye. The purchaser of a boar should satisfy himself as to the manner in which the pig has been bred, even more fully than with regard to his form. As respects shape, the boar should be broad across the back from the neck to the tail—this involves broad shoulders, well-shaped ribs, broad chine, and thick hams. He should possess depth of carcase throughout, and have proportionately short legs; the chest and rump should be wide; in fact, the pig should be as nearly rectangular in form as possible, and the head small and fine. For breeding boars of this description, a sow of similar form and good descent should be selected; and care should be taken to secure a length of side, for this indicates a desirable capacity for the full development of her young.

The Poor Man's Pig.—The testimony of working-men is decidedly in favor of the thick bacon of a large sort of pig. This, indeed, may be considered the poor man's bacon; for, no doubt, the slower growth of such meat enables it to impart greater strength to the system. If this, then, is the poor man's bacon, does it follow that the animal producing it is the poor man's pig? I think not. He has the choice of producing his own meat from the waste of his garden by the slow and expensive animal which yields that which is most suited to him, or else he may sell his own produce and purchase that which he wants. I should recommend a laborer to consume his waste-garden produce in preparing useful store-pigs, and sell rather than attempt to fatten them. In the sale he will experience no difficulty; he will not incur the necessity of buying meal, but he may thus accumulate a fund which will enable him to purchase the large and coarse bacon he wants at much less than he could produce it. Thus, while he is making the best of the waste from his garden and selling his produce well—for he should secure pigs of good quality for his purpose—he will be able to buy the bacon best suited for his use at eighteen-pence or two shillings per score less than his own meat of finer quality would fetch in the market. The laborer, in disposing of his pigs in good store condition, would sell that which would pay him most money, and he would be able to buy the lowest priced bacon, which would be to him of the greatest value.

Management of Pigs whilst Breeding.—Guided by the principles and practices already named, we may presume that the boar and sow have been selected according to the requirements of the breeder. We may, therefore, proceed to notice their management whilst breeding. Two farrows in each year will be sufficient for the strength of the sow and for the prosperity of the progeny. The first farrow should be produced in March or April, and the second farrow in September or October. Whilst the sow is breeding, she should be moderately fed, but not allowed to get fat. It will be better to keep her with other sows which are also breeding; but, after the second month, she should be kept apart from the stores, so as to ensure quietness, without being cramped up in a sty. A week before her time is up (which may be calculated as 16 weeks), she should be put in a comfortable sty, with but little bedding, and this should be in a small and broken condition; she should be fed upon the dairy-waste, warm wash, with bran, or some similar food—watery, but still nutritious. This will encourage the milk and favor the birth of her offspring in other ways. It is very seldom that sows require any assistance in farrowing. After the birth, the sow should be fed with similar food to that she has already been receiving: this should be good, but not heating. For this purpose, bran is as good as anything; but meal has a tendency to produce fever in the system, and is, therefore, unfavorable to the formation of milk.

Management of Young Pigs.—Attention to the food of the sow, together with a dry, well-littered, and clean sty, are the early essentials to health. When five or six weeks old, the young pigs should be castrated. Young sows are not so generally operated upon now as formerly. One reason for this is, that the increasing delicacy of our improved breeds renders the operation more hazardous, and the losses by death are consequently greater; the necessity, also, is diminished by the same cause, for their breeding powers are weaker. It is, however, absolutely necessary in the case of young boars: for, apart from the strong flavor which the meat would acquire if the operation were neglected, great inconvenience would be experienced among the stock. If a low trough be put in the sty, the young pigs may have some wash or scalded bran in it, and this will get them into the way of eating. After this they may be gradually got to the use of meal in the wash; and for this purpose a mixed meal of peas and barley, or peas and oats, will be very desirable. They should not have any meal when suffering from the effects of castration, as it would favor inflammation, but at such time there will be no objection to bran. When they are about eight weeks old they may be weaned from the sow; and after this their food should be liberally supplied, especially the waste milk and whey from the dairy. Their food, which ought to be warm, should for a time be given thrice a day. After a short time, and especially when they are turned out into a small yard, a small allowance of clover or vetches occasionally will be a good thing for them. Indeed, a more general use of clover and vetches would be found highly remunerative in the case of pigs, for both are valuable for young growing animals. The autumn farrow would require other sustenance, and the swede or mangold-wurtzel —either boiled or grated by machine—might generally take the place of this green food. If warm food is necessary, the former plan may be adopted, but the latter answers very well in all other cases; and, if the pigs are tolerably strong, they not only thrive equally well, but much labor and fuel are saved. The manner in which the stores are to be kept will depend upon the system adopted. To this reference has already been made; and it may here be added that no system is desirable unless the pigs are kept in an improving state; it may be a slower rate of progress in some cases than in others, but still they should be kept thriving.

Management of Pigs when Fattening.—This should be commenced or preceded by a moderately good feeding, so as to get the pig in good store condition. To give a *poor* pig strong fattening food must for a time be attended by loss. The system is unaccustomed to rich food and cannot appropriate it, because (as shown in previous papers) it has no fat-cells ready to receive it. These would be produced by food of moderately good quality, after which the pig might have stronger food, and would be able to make good use of it. When meal is given to pigs for the purpose of fattening them, its *liberal* use is most economical. It should be supplied three times daily at *regular* intervals, and should be given as a thick paste. The feeder should give them as much at each meal as they can eat, and, should any remain in the trough, it should be shut off from the pigs by a moveable flap, in which case they receive it with their next meal; but the careful feeder will soon know what they can manage to consume. After feeding they should be kept as quiet as possible, for the more they sleep the more progress they will make. It is a sure sign that they are not paying when fatting pigs are seen wandering about the sty: the sooner they are made lazy, the sooner they begin to pay. Our improved breeds have a great aptitude for fattening, but this tendency is regulated by the same principles that operate in all other stock. As these have been somewhat fully explained, it is unnecessary to dilate upon the subject here. It is, however, singular to observe the primitive manner in which the Indians manage to fatten their wild boars, after having made a capture of them. The boar having been taken alive and properly secured, they sew up the eyelids and turn him into a place of confinement, where he soon tires himself in searching for a means of escape. Then giving up all hope of getting away (which, if persevered in, would have kept him fretful and restless), he settles down quietly and makes the best of his altered circumstances.

In no case has the present system of high-feeding been carried to an extent equal to that observed in the feeding of pigs. Our Exhibitions at the Smithfield Club and Birmingham have many examples of pigs reduced to the last stage of helplessness; some requiring their heads to be supported by rollers to enable them to breathe, whilst others have to be assisted to their food by the aid of a spoon. We certainly do not sew up their eyes, like the Indians, but we close them as effectually. No one pretends to advocate this excessive fattening, further than as a proof of what any particular breed of pigs can be brought to: it is as much the test of power as "the Derby" is to our horses. The point to establish is, What pigs can produce the greatest weight in the shortest time? But these trials would be much more valuable if we knew the quantities of food consumed, so that we might also judge which had been produced at the least cost. A phamphlet has recently been published,* addressed to the breeders, feeders, judges, and exhibitors of cattle, respecting the diseased prize cattle exhibited at the Smithfield Club, and, as it is calculated to mislead, some reference to it is desirable. The writer, in condemning the system of over-feeding, appears to lose sight of the fact that these prize-animals are only trials of strength, and that no one would think of breeding from such stock subsequently. He also attempts to show that meat produced under *"the high-pressure system"* is diseased in its character, but his arguments are incorrect. I have elsewhere shown the great impolicy of excessive fatness in *breeding animals*, but, when an animal has finished these duties, or when the merits of a breed are to be tested, by all means let evidence be given of the meat-producing capabilities.

* * * * * * * *

The best Mode of Curing and Keeping Bacon, and its value as Food. * * * * * * *

The following is the best plan for curing bacon by *dry-salting:* Procure a salting board or bench, or else a trough made of slate of the size required, and have a groove made round it to carry off the brine which may be formed, so that it may fall into proper vessels placed to receive it. The following materials are required for a pig of 14 score weight:

10 lbs. salt,
4 ozs. saltpetre,
½ lb. bay salt,
1 lb. coarse sugar.

The meat being laid upon the salting bench, *the skin side* is first rubbed over with some of the sugar. When this is done, the salt, which has been *thoroughly* dried in an oven, is, immediately it is cold, mixed with the other ingredients, and the meat is well rubbed with it. The residue, being apportioned to the several joints, is laid upon the meat. If the weather be warm and moist the salting proceeds more rapidly than when it is cold and dry. In about seven days the meat is again rubbed; that which is below is brought to the top, and the under sides are also turned. This is repeated for a third or fourth time, according to the judgment of the manager, and then the bacon is ready for drying. There is a great difference in the ingredients used by different persons in curing bacon. I have known double the proportion of salt stated above, five times the quantity of saltpetre, and ten times the quantity of sugar regularly used for bacon: but, for reasons hereafter stated, I am inclined to think that, as the quantities first named are sufficient, the additional quantities sometimes used are not only unnecessary, but, in certain cases, prejudicial. Some also rub the bacon and hams *daily* instead of *weekly*, as named above; this *may* be useful, but certainly is not essential. In some parts of Ireland a piece of wood is used as a rubber for the meat. After the curing is completed, the bacon and hams are dried with a cloth; sometimes also they are rubbed with bran, and hung up for drying or smoking.

---

* 'Evil Results of over-feeding Cattle,' by F. J. Gant, M. R. C. S.

The *Pickling* of bacon is done in the following manner: The pickle is prepared by dissolving salt in water until an egg will float on it; to every 2 gallons of brine add ½ lb. of saltpetre and 1 lb. of coarse sugar. The meat being packed as closely as possible in the vessel used for the purpose, it is then pressed down by two or more large stones in order to keep it from floating; the pickle is then poured in and the vessel closely covered. Some persons keep their meat constantly in the pickle, but others hang it up to dry in three, four, or five weeks. Hams are frequently done in the following manner, and the recipe given will produce the finest possible flavor and quality: For a ham of 12 lbs. weight mix together common salt 8 oz., saltpetre 2 oz., juniper berries 3 oz., cochineal ½ dram, and brown sugar 6 oz.; let the ham be well rubbed in a pan daily for 12 or 14 days, and then hang it to dry.

After the meat has been thus salted, the next stage is the drying of the bacon and hams. This requires care; for, whilst it is necessary to get it sufficiently dry, it is objectionable to carry the process too far. Exposure to a dry current of air is the best mode of drying bacon. Some use bacon-hutches: these are nothing more than sparred frames fixed within 6 or 8 inches of the kitchen ceiling. In some houses the producê of six or more pigs may be seen thus suspended. This only answers when the kitchen is large and airy; for the direct heat of the fire or a warm room will turn the bacon rancid. This does not, however, happen in large and well-ventilated rooms. When the kitchen is considered too hot, it is a good plan, after three or four days, to remove the bacon to the dairy, and then bring it back again; thus keeping it for three or four days in the kitchen and the dairy alternately. By this means it will dry gradually, and will afterwards keep more easily. Other persons hang their bacon in rooms which are kept as cold, dark, and well ventilated as possible. A deep chest is often used for storing dry bacon and hams. In such cases it is customary to have layers of dry wood-ashes, fresh malt-dust, bran, or saw-dust, but not fir. Each plan has its advocates, whilst others prefer the plan of simply hanging the bacon from the kitchen ceiling.

When the bacon or ham is to be smoked, it is wiped dry from the pickle or salt, and either hung up in the kitchen chimney (presuming it to be a wood fire), or else smoked in a proper smoking-house. When a large quantity has to be done, the latter is the better and more economical plan. The great fault with the generality of smoking-houses is, that they are not high enough: it is clearly established that the best smoking is done in lofty smoke-houses, or else by some contrivance for generating the smoke out of the house, whereby it is rendered cool and free from moisture before it comes in contact with the meat. The object of smoking is two-fold: to dry the meat, and also to give it a peculiar flavor. This latter object is sometimes attempted by the use of impure pyroligneous acid, or, as it is more commonly termed, "essence of smoke;" this, however, is far inferior to good smoking.

The great enemy to bacon and ham is a leaping maggot, which is produced by a fly named *Piophilla*. The fly generally attacks the best cured meat. The usual mode of protection is the use of paper or cloth bags, but even then the fly will gain entrance if there be the smallest opening. Various other expedients are adopted. The use of juniper-berries or black pepper in the pickle is frequently resorted to as a means of keeping off the fly; and the former has an additional recommendation in the case of hams, on account of the flavor it imparts. Others sift lime over them: this is known to be successfully done in the midland counties, and it is said that Westphalian hams are thus treated. In Yorkshire, after the hams and bacon are wiped dry, they are well dusted with flour, hung up in the kitchen for two weeks, then removed to a cool room, and the kitchen ceiling is immediately washed with quicklime and water. The Americans use a paste of very fine wood-ashes and warm water. Should the maggot have got into the meat, a strong infusion of cayenne pepper is said to displace it immediately. It is also stated that so long as it does not reach the bone, the loss is confined to the part consumed by it, but after it has reached the bone an unpleasant flavor diffuses itself through the meat.

These are the processes for curing and keeping bacon suitable for private families, but when the manufacture is carried out to a large extent for exportation a less careful system is adopted. Only two peculiarities need be noticed. In salting pork for navy purposes, the usual plan is to pack the meat into water-tight casks, and pour into it a strong solution of salt, with a little saltpetre; it is then fastened down at once. In America they mix *wood-ashes* with their salt, and with this the meat is rubbed for six or seven weeks, during which time it is constantly turned. The former plan is objectionable. In an article of so much importance to the navy greater care is desirable, and a more perfect system should be insisted upon. With the above facts before us, it is now desirable that we inquire into the merits of these several practices, with a view to ascertain what it is that occasions these various results.

As soon as any animal is killed its body loses its great preservative against the universal law of change: as vital action is no longer operative, the body becomes immediately subject to the influence of decay. There is nothing about flesh calculated to preserve it; on the other hand, from its composition, it has a peculiar tendency to putrefaction. Its general composition, according to Liebig, is

Water	76 to 79 per cent.
Soluble albumen . . .	2 " 3 "
Fibrin and insoluble matter .	17 " 18 "

The large proportion of water shows a predisposition to decay, but it is the soluble albumen in the body which excites the putrefaction. Hence, from the moment vital action ceases, the process of putrefaction commences. For a time it remains in an incipient stage, but as soon as the animal is cut up the free access of the air encourages the change.

When flesh is pressed a fluid is obtained from it, known as *the juice of flesh.* We are all familiar with it as the gravy of meat. If a piece of flesh be cut up into small pieces and placed in water, the water gradually enters into the meat and displaces its natural juices, but if a little salt be added it does so more completely, and in less time. Under this treatment the flesh loses its color and becomes insipid. This arises from the removal of the juices of the meat; and when this is fully accomplished we have fibrin remaining in a form highly indigestible, and of little nutritive value. A similar change takes place when meat is carelessly salted; the result is that food, indigestible or of inferior nutritive value, is produced. In the processes for curing meat two very distinct methods are adopted; the bacon is sometimes pickled, at other times dry-salted. In both cases the salt penetrates and is carried into the juice of the meat. But there is this marked difference: the watery pickle encourages a free interchange of the fluids, whereas in dry-salting this is avoided. In the one case the juice of the meat often passes into the pickle; in the other instance it is chiefly retained in the meat. The advantages of dry-salting are only fully realized when the salt has been thoroughly dried. Salt, from its attraction for moisture, soon draws it from the air, and when used in this state for meat a much larger quantity is required to do the same work. The salt thus having water in it before it is placed on the meat is soon washed off from it by the flow of the juice; but if the salt be thoroughly dry it not only seizes the juice exuding, but in its avidity for the watery juice it penetrates into the meat. This, it is believed, will explain the great variation named in the quantity of salt used by different persons.

The reader is probably aware that the digestion of food is promoted by the gastric juice which the stomach pours upon it. By this means a chemical action is induced in the food, which prepares it for being taken up into the system. Liebig has shown that the juice of meat corresponds in character and composition with this gastric juice. Thus it will be seen that the meat we eat carries with it the materials for promoting its own digestion. If, however, we remove the juice from flesh we render it indigestible, because we take away the digesting agent which is necessary for enabling the stomach to discharge its functions. It has been already shown that, by soaking meat in water, and especially if salt be added, the juice of flesh can be entirely removed and the meat thereby rendered valueless. It is therefore certain that if meat is to be salted satisfactorily some control must be exercised. We find sugar or treacle used: its action is said to be, that it gives richness to the meat, and probably renders it more digestible. We know that the active agent in the juice of meat, as well as in the gastric juice, is lactic acid. This body can be formed from sugar when in contact with animal matter. Can it be, that the sugar used can have this duty to perform? and that, being brought in contact with the meat, a decomposition takes place in which it shares, and renders the meat more digestible, by adding to the quantity of lactic acid present, or in supplying the deficiency caused by the extraction of the juice? In the use of saltpetre we have a body which preserves the color by supplying potash, and decreases the extractive action of the salt by its astringent action upon the flesh. Liebig has observed that the presence of lime and magnesia in the juice renders meat more digestible. Here then we see the especial value of bay salt, and also the reason why it is only wanted in a small proportion, for adding a little lime and magnesia to the meat. The Americans, however, do not use either bay salt or saltpetre, but wood-ashes, in which we find lime, magnesia, and potash. Can we fail to detect in this the supply of those bodies which are rendered necessary by the removal of the juice of flesh whilst the salt preserves the meat from putrefactive decay? If salt be added to meat, without any saltpetre being mixed with it, the juice of the meat is extracted, the potash of the meat is lost, and with it the color also; but if the salt be accompanied by potash, the color of the meat is preserved and the powerful extractive action of the salt is at the same time controlled. When, however, the necessary quantity has been used, any addition to it is both unnecessary and injurious, for it gives the flesh a very undesirable hardness. When it is mixed with salt which has not been properly dried, a large quantity has to be used, but this should be avoided by a proper preparation of the salt. The additional quantity of sugar is far less objectionable, for it does no harm if it does no good; and it would be difficult to suggest what quantity of sugar is best, for it it is clear that it imparts to the meat a mellowness and richness which are very desirable. When bay salt is used it reduces the quantity of common salt which is necessary far beyond its own weight; but the cause of this has been pointed out. Whilst therefore we look upon the indiscreet use of salt for meat as a means of drawing from it its nutritious qualities, because we thus take away that which makes it digestible, still we see that, *by the use of* *bodies adapted to replace those removed in the juice of meat,* we may considerably diminish the evil. Not that salt meat will ever be as nutritious as fresh meat, but we have in the modified plans of curing meat the means of preserving it with as little detriment as possible. I have not the slightest doubt but that each of the bodies used in the best curing compounds is necessary, and performs a decided duty in preserving the meat, and should be used in all cases where it is wished to retain as far as possible the quality of the meat and render it digestible.

My own observation leads me to believe that the reason for pickle being so generally used in the West of England and some other parts, in preference to dry salting—which is equally general throughout other parts of England—is, because of the moist climate which renders it very difficult to keep salt meat properly *dry.* This is a local peculiarity which accounts for the discrepancy in practice. With this exception, the merits of the dry-salting and the pickling processes are tolerably clear. A preference will generally be given to the use of a pickle for small hams intended for boiling, and also for young pork; but when a large ham of from 20 to 40 lbs. weight, or when bacon has to be cured, there is no question (unless climate interferes) as to the superiority of the dry-salting process. A pickled ham, when broiled, is hard and tough, but a slice from a dry-salted ham is rich and tender. The reason of this is obvious. By pickling the ham you have drawn off its juices to a great extent by keeping it in a fluid, but when dry-salted the juices of the meat are more thoroughly preserved. In *young* meat, such as small hams or pork, especially if it is to be boiled, the digestive action of the juice of meat is not so important, because the fibres are tender; but when we have larger and *older* meat to deal with muscles have a greater firmness, and unless the digesting juice accompanies it we are using comparatively dry and indigestible food. I have before spoken of the superior quality and flavor of four and five years old hams, but these qualities are only fully realized when the pig has been well fed before being killed, so as to get the flesh well charged with rich juice. This is explained on the principle just named. The ham of an old pig, which has been poorly fed, will be poor and dry eating; but if an animal has been killed in good condition it is just the reverse. An old ham to be good must have its natural juice, and whether you kill the pig when out of condition, or, having killed it in good condition, afterwards extract its juices by a watery pickle, the same result will be obtained in each case, viz. dry and indigestible food; but if the pig be killed in good condition, and the hams judiciously cured, so as to preserve the juice, then you will secure a rich, full-flavored, and tender ham, either for broiling or boiling. The strongest instance I know to show that age, when accompanied with good feeding, does not prejudice the quality of the meat, is that named in White's 'Natural History of Selborne,' where a sow kept as a curiosity, and killed when 17 years old, after having given birth to 300 pigs, proved "good bacon, juicy, and tender."

Under the most perfect system of curing meat, it thus appears possible to lose nothing more than the albumen of the juice; but it is curious to observe that the usual accompaniments of bacon are rich in albuminous matter. Beans and bacon, peas and bacon, eggs and bacon, and cabbage and bacon, are as regular accompaniments of each other as any dishes we have. This appears to indicate that we are often insensibly led to adopt very judicious practices without knowing why we do so, or what object is to be gained thereby.

Diseases of Pigs.—These are not numerous, and the following are the most important:—

Inflammation of the Lungs.—The symptons are quickened, labored breathing, frequent cough, and loss of appetite. The pig should be bled, and the following medicine given. To a medium size pig give—

Calomel	3 grains.
Tartar emetic . . .	4 "
Nitre	20 "

and repeat the dose on two succeeding days. Then for a few days give—

Digitalis	2 grains.
Tartar emetic . . .	4 "
Nitre	20 "

Diarrhœa.—The symptoms are violent purging. In sucking-pigs this is often caused by the sow's milk. The simplest remedy for this is, to put a moderate sized lump of quick lime into a pail of water, and, of the lime-water thus made, give the sow a pint in her food once or twice a day. When the diarrhœa takes place in older pigs it is generally an effort of nature to throw off some irritating matter from the intestines; this should therefore be assisted by 2 or 3 ounces of linseed oil, and, if it continue after this has acted, give 2 or 3 tablespoonfuls of the following mixture:

Catechu	1½ ounces.
Spirits of wine	1½ "
Laudanum	2 "
Ground ginger	½ "
Water	1 pint.

Spasms.—The symptoms are violent attacks of pain, during which the pig rolls about, with intervals of freedom from pain. As soon as possible after the spasms, give—

Spirits of nitre	4 drams.
Laudanum	3 "

and soon afterwards give 3 or 4 ounces of linseed-oil.